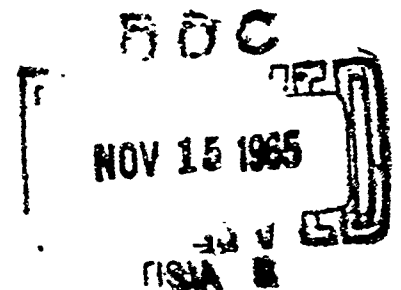


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LOGISTICS RESEARCH CONFERENCE

VOLUME II - I

Individual Professional Papers
Pertaining to Panel I Discussion
On LOGISTICS PLANNING
ELEMENTS

FOREWORD

The *individual professional papers* contained in this volume were prepared for presentation to the Panel on Logistics Planning Elements (Panel 1) at the Department of Defense Logistics Research Conference held at the Airlie Conference Center, Warrenton, Virginia, 26-28 May 1965. They are published for information and background in relation to Panel 1 deliberations.

Publication of these individual professional papers by the Department of Defense does not necessarily signify that they represent a consensus of the Panel on Logistics Planning Elements or the views of the Office of the Secretary of Defense.


NATHAN BRODSKY
Conference Chairman

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LOGISTICS PLANNING FOR READINESS

Norman Belonofsky

DEFINITIONS. Definitions of military terms are contained in the Dictionary of United States Terms for Joint Usage (JCS PUB 1) except as indicated. The following definitions have been identified as being of significant interest:

Cold War. A state of international tension wherein political, economical, technological, sociological, psychological, paramilitary, and military measures, short of overt armed conflict involving regular military forces, are employed to achieve national objectives.

Contingency: (Definition not included in JCS PUB 1). A situation of major proportion which can be reasonably anticipated in a specific geographic area.

DSA War and Emergency Support Plan (WESP) (Definition not included in JCS PUB 1.) The document which will provide planning guidance for preparing for general war. This guidance will be utilized to support emergencies, contingencies, and cold or limited war.

Field Activity War and Emergency Support Plan (FAWESP) (Definition not included in JCS PUB 1). The war and emergency support plan developed by DSA field activity.

General War. Armed conflict between the major powers of the communist and free world in which the total resources of the belligerents are employed, and the national survival of a major belligerent is in jeopardy.

Limited War. Armed conflict short of general war, exclusive of incidents, involving the overt engagement of the military forces of two or more nations.

Mobilization. The act of preparing for war or other emergencies through assembling and organizing national resources. The process by which the armed forces, or part of them, are brought to a state of readiness for war or other national emergency. This includes assembling and organizing personnel, supplies, and material for active military service.

Background

It is the purpose of this paper to discuss logistics readiness planning in terms of preparing for the ultimate posture required in war or emergency conditions; that is, general war. As corollary, it is assumed that by preparing for this ultimate, the logistic support requirements for intermediate escalation phases could be satisfactorily accomplished; e.g., cold war, contingencies, limited war.

In order that readers of this paper may have a similar base of knowledge of the responsibilities of the Agency involved, it is considered appropriate to discuss briefly the evolution of the Defense Supply Agency (DSA). It is one of a number of recently established DOD agencies whose origin stems from the "integrated management" concept. In essence, this concept proposes one manager for common supplies or services with resulting economies and efficiencies. On this basis, the Defense Supply Agency was established on 1 October 1961 reporting directly to the Secretary of Defense with a mission of providing common use supplies and services to the Military Services, other elements of the Department of Defense and to Federal civil agencies as assigned by the Secretary of Defense. Vice Admiral J. M. Lyle, USN, is the Director. Headquarters is located at Cameron Station, Virginia.

The Agency supports its customers with such commodities as food, clothing and textiles, medical, chemical, general, industrial, construction, petroleum, and electronics supplies. In addition, it manages idle industrial plant equipment and maintains central records of all plant equipment owned by the Department of Defense. It also procures and distributes food, sanitation and medical kits for the Civil Defense fallout shelter program. In the common service field, DSA administers the Federal Supply Catalog for the Defense establishment, Federal civil agencies and other users, and supervises Defense-wide programs for materiel utilization, technical documentation services, coordinated procurement, and surplus property disposal. In June 1964, the Secretary of Defense directed that defense contract administration services including quality assurance, production expediting, industrial security, accounting and payment of contractors, also should be under the management of DSA.

DSA currently employs approximately 32,000 civilians and about 900 military personnel of the Army, Navy, Air Force, and Marine Corps. The Agency manages 1,300,000 items of supply in an inventory valued at \$2.1 billion. Procurement in FY 65 should amount to approximately \$3 billion. DSA accomplishes its supply and service mission through a series of Supply Centers, distribution depots, and special service centers.

Example of Logistics Research Which is Being Applied Effectively within the Defense Supply Agency

In view of the magnitude and scope of the operations of the DSA, a special mobilization planning task force was mandated to study the planning needs of DSA in order to develop the "tools" required to permit conversion from a peacetime effort to wartime operations in a timely and orderly manner. The research was to cover the needs of DSA Headquarters and field activities in such areas as functional realignment; revised/reduced reporting requirements; and "emergency check list" of actions to be promulgated under specified conditions; e.g., mobilization, limited war, etc.; standby directives including legislative

requests and proposed executive orders, etc. Research indicated that the most desirable method for promulgation of appropriate logistics support planning guidance would be through the media of a plan which should incorporate basic guidance including objectives, general (strategic) considerations, policies and assumptions and, in addition, annexes containing detailed technical guidance to be prepared by the functional staff elements within the DSA Headquarters.

The recommendations of the study group were approved which will cause a DSA War & Emergency Support Plan (WESP) to be developed whose purpose will be to prescribe the DSA plan of action prior to or during war and emergency conditions. The WESP will be utilized by DSA field activities as the basis for development of their Field Activity War and Emergency Support Plan (FAWESP). In addition to the development of these plans, the study indicated a need for a DSA War and Emergency Program (WEP) document which will reflect the programming objectives, policies, and time phasing of actions relating to manpower, materiel, and facility requirements for support of the WESP. It is considered that the following planning objectives will accrue through the development and implementation of the WESP:

More definitive guidelines will be established to assure DSA support under varying conditions of emergencies; contingencies; and cold, limited, or general war.

Responsiveness to the war and emergency plans of the office of the Secretary of Defense, Joint Chiefs of Staff, the Military Departments, and Federal civil agencies of the United States Government will be insured.

Provisions for control and operations under wartime conditions and directives.

Improvement of the survival potential of DSA logistics resources in general war through protection, dispersal, etc.

Providing the best possible level of efficiency and responsiveness to operational requirements with emphasis on simplification, accuracy, and economy of money, materiel, facilities, and manpower.

In addition to determining the guidelines for the development of the most desirable planning means for converting to a wartime posture, research indicated a decided need for assessing the readiness position of the Agency to furnish logistics support under the various emergency or war conditions. Accordingly, the requirement for determining the readiness condition of the Agency was incorporated in the planning guidance.

Personal Views of Required Logistics Research
(Limited to War and Emergency Planning)

The following personal views of requirements for further research in the area of war and emergency planning are furnished. It is recognized that all of the areas listed below have undergone extensive research. However, due to the dynamic nature and fluidity of strategic planning, further and continuing research is considered necessary.

The extent to which war and emergency planning should be accomplished, e.g., should planning only encompass contingencies, should planning extend to limited war, etc.

Methodology to be used for determining resources in anticipation of build-up or redeployment of troop strength under any of the various emergency or war conditions.

Interface between the military and civilian economy during general war conditions, e.g., the extent to which the civilian economy will be dependent on the military for logistical support.

Vulnerability of DOD logistic support elements, i.e., inventory control points, communication systems, power, storage sites, etc.

Alternate systems to be utilized in event of failure of electronic data processing equipment during emergencies and war conditions.

Methodology for determining requirements for repair parts and secondary items during a build-up or redeployment of troops or weapon systems.

Personal Views re Making Results of Logistics
Research More Readily Useable and Available for Logistics Planners

The following areas are considered significant in terms of making the results of logistics research more readily useable and available to the logistic planner.

Results of logistics research efforts should be constantly aimed towards the practical application of the findings rather than theoretical application.

Research studies should initially be made available to the logistics planner in the form of a summary report highlighting briefly areas covered, findings, conclusions and recommendations. Conclusions and recommendations should be in specific terms rather than generalized statements subject to various interpretations.

11 June 1965

LOGISTIC PLANNING ELEMENTS

Prepared by
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Under Sponsorship of
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For Committee No. 1
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Introduction

Since there are many differing concepts of what may be meant by the general term Logistic Planning, it is inevitable that there be wide differences in the terminology and the relative emphasis placed on various elements of this complex process.

() If research in logistics is to be well directed and coordinated, conceptual unity must somehow be established. In particular we need a coherent and comprehensive statement of the fundamental nature and basic structure of logistics and of logistic planning. Thereafter we need to understand cause and the effect relationships, general principles, and criteria by which we can judge the merit of logistic systems and policies.

In this discussion I make no special attempt to conform to current Department of Defense terminology and practice but rather I seek to express the fundamentals of the problem in more enduring terms.

Nature, Phases, and Structure of Logistics

Logistics can be understood only if it is clearly related to the other major parts of overall military theory and structure as viewed from the perspective of command.

Command and management are not synonymous. The responsibilities of command are greater than those of management because command involves ultimate questions of life and death for men and cities. Command, however, must utilize sound management procedures and techniques throughout the military system.

The fundamental relations as shown in Chart I are:

Strategy is the comprehensive direction of power to control situations and areas to attain broad objectives;

Tactics is the immediate employment of forces and weapons to attain strategic objectives;

Logistics is the creation and sustained support of weapons and forces to be tactically employed to attain strategic objectives;

The Functions of Command are threefold: to create combat forces, to support combat forces, to employ combat forces. The understanding of good management practice is essential to the successful performance of the first two functions.

Strategy governs the comprehensive employment of combat forces, tactics governs their immediate employment and logistics has the dual role of both creating the forces and thereafter providing their sustained support.

Duncan Ballantine wrote, "As the link between the war front and the home front, the logistic process is at once the military element in the nation's economy and the economic element in its military operations." This has the corollary that there are two phases in logistics, the producer phase and the consumer or user phase. The element of duality is illustrated

by these two phases which in turn produces tension, overlap, and duplication as inherent characteristics of logistic organization and action.

Several further immediate and important corollaries are: Since operations is a blend of tactical action and logistic action in order to attain the objectives set by strategy, operations can never be divorced from logistics. Logistics action must take place before tactical action becomes physically possible.

The Purpose

The purpose of logistic effort is to create combat forces and to provide them with sustained support. From this dual purpose we have the corollaries that: (1) Readiness for combat and combat effectiveness are the chief criteria by which to judge logistic activity; (2) the concepts of military essentiality and cost effectiveness are both fundamental to logistic judgment and planning.

The complexity of this problem of evaluation is illustrated further by the manner in which the purpose, the nature, and the phases of logistics combine to give further corollaries that:

The logistic system must be in harmony both with the economic system and with the tactical concepts and environment of the combat forces.

The business community is in natural harmony with the economic system. Combat operations are naturally antagonistic to the economic system.

Economic factors limit the combat forces one can create, i.e., Mobilization Planning.

Logistic factors limit the combat forces one can employ, i.e., Operational Planning.

These tensions and resultant uncertainties have brought about two further types or categories of planning: Requirements planning, i.e., what do I need to provide in order to do what I would like to do? and Capabilities planning, i.e., what can I do with what I have.

The structure of logistics is shown by its basic elements, aspects and functional categories.

The elements are:

REQUIREMENTS, PROCUREMENT, and DISTRIBUTION,

The Command actions or aspects are:

ORGANIZATION, PLANNING, EXECUTION, and SUPERVISION.

These elements and aspects apply to all levels and areas of logistics and blend and overlap in various ways and in them the concepts and techniques of business management are very important.

The Command actions take place in various functional categories which in general terms are: MEN, MATERIALS, FACILITIES, SERVICES, and FINANCE. All of these influence each other in very complex ways.

The operational functional categories vary considerably with the nature of the particular theater of operations and type of command but they generally are:

Personnel, Medical, Supply, Transportation, Construction, and Maintenance and Repair.

Each of these has many sub categories.

Management Techniques

In addition to other matters certain management techniques are particularly significant to the successful efficient performance of the Command actions. To cite a few:

Systems analysis, Programming, Queuing, Inventory Management and Control, Pricing, Purchasing, Contracting, Production Control, Quality Control, etc., and special financial matters such as Budgeting, Financial Control, and Stock Funding, etc.

While these techniques apply principally to the producer phase of logistics, they also have many important applications to the consumer phase.

But since the major purpose and ultimate pay off of all defense effort lies in successful tactical operations of combat forces, I emphasize operations planning rather than mobilization planning, important though it is.

Operational Planning

The two major phases of operational planning, the Estimate of the Situation and the Development of the Plan, contain the key to the essential concept of integrated planning.

In the Estimate of the Situation the decision as to the course of action to be taken is made by the responsible commander on the basis of his evaluation of the strategical, logistical, and tactical aspects of the situation as made available to him through his intelligence, communications, and information systems. In this process, while he has major personal responsibility for determining the strategic concept, the command organization and the forces to be employed, he depends heavily on the information and studies of his staff. In particular the staff identifies probable critical elements and important logistic deficiencies as the concept is being developed. In this decision, the commander

himself decides on the degree of logistical and tactical risk he will impose on his subordinate forces in order to accomplish his strategic objective. This calculation of risk determination of logistic feasibility is made by the commander on the basis of his own evaluation of the analyses and recommendations which may be made by his staff. At this phase of planning, the logistic aspects of the Estimate of the Situation are usually in the form of highly aggregated numerical logistic planning factors as related to tactical needs, time, and distance with special attention to the identification and evaluation of criticality.

While this concept of personal command responsibility is not always used in planning at the highest levels, the main points do apply: the integration of strategic, logistical, and tactical considerations is a simultaneous process not a sequential process; such integration requires a superior quality of military judgment and competence.

After the estimate has been made and the decision reached, the second phase of planning, the Development of the Plan, is undertaken. In this the various details of the tactical action and logistic action which together constitute "Operations" are worked out. In this process, much more detailed numerical planning factors must be used. If hitherto unsuspected elements of critical deficiencies are disclosed, it may be necessary for the commander to alter or radically revise his estimate. But normally, if the original estimate has been a good one, modifications in the basic course of action will be minor.

This brings us to the crux of a major logistics research problem: If this concept of integrated planning is understood and applied in our

educational, our war gaming, and our research groups, there will be no need to develop elaborate and artificial interface devices to insure that logistic planning is in harmony with national policy and strategic concepts and plans.

If on the other hand we insist on maintaining the fictions that logistics is not an inherent part of operations, and that a strategic plan can be developed before a logistic analysis is made, then we face a frustrating, expensive, and very complex problem of developing organizational and technological gadgets to substitute for sound military judgment and professional competence.

The above has the immediate implications that:

A. The process of military decision needs major analysis and emphasis in our war colleges.

B. The availability of up-to-date aggregated numerical logistic planning factors is an essential element in effective high level military decision and planning wherever it may take place.

Logistic Planning Factors

The logistic planning factors discussed herein are numbers which represent the quantitative relation between the conduct of military operations and the consumption and utilization of logistic resources in terms of time, men, materials, facilities and services.

Logistic Planning Factors of one sort or another are used to:

Make Strategic Decisions;

Prepare Strategic and Tactical Plans;

Prepare Logistic Plans;

Prepare Military Budgets at all levels;

Determine the optimum balance of Combat and Logistic Forces;

Design forces, ships, and equipment.

Obviously, the same precise factors will not be suitable for all these uses. However, if there is conceptual unity in analyzing and developing the factors and if they are generally based on the same fundamental data, a family of compatible planning factors can be developed. The element of compatibility will be very valuable in relating estimates in one area to those in another area.

There are two basic sources of data from which to develop good planning factors.

One is usage data. This must be very carefully analyzed before it becomes a useful planning factor. This type of factor is most useful when the ship or equipment can build up some kind of history before the factor is determined.

However, the rapid rate of development and obsolescence of modern equipment demands that planning factors be developed before a useful history of usage can be obtained. Therefore, experimental and design data must be projected and analyzed to develop the planning factors. This poses the difficult but important problem of getting manufacturers data on part failures during development.

The system of factors should be divided into groups of various degrees of aggregation so as to provide for the needs of various levels and areas of planning--all groups being based on the same usage or experimental data. This is very important for only then is it possible

to expect harmony in planning among the various commands charged with strategic and operational planning and budgeting.

Since such numbers represent an enormous variety of specific items and conditions, their development and maintenance constitutes a major continuing task which requires highly professional and continuous supervision and coordination; among other matters these planning factors require special consideration and identification as to:

Sources, standard conditions for which calculated, suitability for rapid computation, criticality and military essentiality, commander's judgment factor as related to factors influencing change in demand, the influence of active combat on numbers based on non combat conditions, suitability and ease of aggregation.

As research progresses other matters will of course emerge, but several further points are clear.

Such numbers are always approximations and should not be over-refined. As ships, weapons and equipments change, these numbers will change. If their accumulation and study is overly delegated they soon will become inaccurate and meaningless. Integrity and timeliness are both important. Aggregation problems will vary with the level of command, with criticality and with the degree of centralization of authority.

Further Considerations

The numbers are very closely related to the numbers and reporting systems used in studies of operational readiness.

Both logistic planning factors and operational readiness indices are vital parts of our national and service command control systems.

The tensions and debates coming from the inherent duality of logistics are found primarily in the question of Command and Control in such matters as:

Regional vs. Functional Command

Type Command vs. Fleet or Task Force Command

Weapons System vs. Task Force or Type Command

Unified Commander vs. Component Commander

Service vs. Service

Civilian vs. Military

Commodity vs. Operational Unit

Centralization vs. Decentralization

Cost vs. Combat Effectiveness

These problems all require the combined approach of research, education and war gaming and in addition they all are directly related to the twin problems of developing command control systems and realistic effectiveness readiness measurement and evaluation.

Readiness

This last problem brings us to the heart of the matter.

The subject of operational readiness is so complex and so important that we should insist on a variety of approaches and of systems of measurement and evaluation.

We should strive to analyze the competing systems on the basis of comparing the component parts of the systems to determine similarities,

identities, and differences. Having done this, we should concentrate on the substantive significance of the differences.

Closely related to this is the further analysis of the elements of readiness which establish three chief categories:

- A. Those elements where quantitative measurements can be made and numerical indices established.
- B. Those elements wherein quantitative measurements cannot be made with assurance and where verbal evaluations based on professional judgment and intuition are the best we can hope for.
- C. Those elements wherein we are uncertain as to whether or not quantitative measurements and numerical indices can be made and assigned.

The Planning Process

The operational planning process always has many uncertainties. Such uncertainties when translated into procurement policies and actual procurement orders can be compensated for by modern methods of demand prediction.

Various statistical devices and methods are useful in dampening the extreme fluctuations of procurement caused by these uncertainties. But this dampening by sophisticated methods of prediction does not take place in operational requirements or distribution to the combat forces. It is a long range, not short range, effect. And combat needs are frequently critical and short range.

And while a fast transportation system will do much to compensate for such uncertainties, the elements of priorities and allocations both in radio frequencies and in air transport must be responsive to the

critical timing and nature of these combat needs and to the special responsibility and knowledge of the combat commander.

The corollaries to such basic facts are:

Logistic planning factors always are approximations.

In times of emergency or crisis, logistic planning always requires some improvisation.

We must provide logistic reserves as well as tactical reserves. This frequently seems to conflict with some modern theories of cost effectiveness and systems analysis.

This requires command control of reserves, of allocations and priorities, of intra-theater transportation.

The application of wise control necessitates that the operational commander have an information system which covers his operational needs and predictions.

This poses still other questions:

What is the nature of such a system? How do we provide proper interface with the longer range and larger overall procurement system?

The interface of logistics with strategy and tactics is primarily an intellectual problem with minor technological features. The great need here is for education in war game practice in integrated planning.

The interface of operational logistics (consumer or user logistics) with overall procurement is both an intellectual problem and a technological problem. Specific research is needed as well as education and war gaming.

Summary and Conclusions

The two most important steps necessary to understand and to improve the major elements of logistic planning are:

A. Establish conceptual unity as to the nature and structure of logistics itself and of logistic planning as they are related to the other major elements of the military problem.

B. Discontinue the custom of compartmented sequential planning wherever it may exist and establish a system of completely integrated planning.

In addition to these fundamental steps which are more a matter of education than of research, it is important to appreciate how further principles and facts are intertwined in accomplishing them.

The ultimate pay-off of logistic effort lies in the sustained operational support of tactical action to attain a strategic purpose. Since operations is a blend of tactical action and logistic action, "operations" cannot be divorced from "logistics" without great harm.

There is distinction between operational planning and procurement or mobilization planning.

Operational planning always entails many approximations and, in time of emergency, many improvisations. There is an important distinction and relationship between the "estimate of the situation" and the "development of the plan."

The study of logistic planning, of operational effectiveness and operational readiness, and of command control systems are closely related. Therefore logistic numerical planning factors must be kept

under continual review, revision and development. This requires the full time of a highly competent senior officer who has exercised operational command.

In these areas, we need to understand how research, education and war gaming should be combined.

Since the ultimate pay-off of logistic effort lies in the sustained operational support of the combat forces, the principle of timely logistic response to critical combat needs is vital. This entails intensive study of military essentiality and of the principles and implications of "command control of logistics."

A further important question requiring logistic research is a multiple one:

How does one identify the elements of logistic planning which require intuitive professional judgment and evaluation, as opposed to quantitative measurement and evaluation of the kind which can be developed and processed by fixed statistical routines?

In the light of the common tendency of senior line officers to underestimate the importance of logistic research and education, how can senior officers be educated so that they can understand the nature of these intuitive professional judgments and make them in a timely, accurate and convincing manner in appropriate cases?

If this can be done the product of other logistics research will be well and promptly applied. If it be not done, the other research will be largely ineffective.

Finally, we should bear in mind that in many areas the basic principles of cause and effect are either unknown or else expressed in terms which are not readily understood by those dealing with the day-to-day aspects of logistics planning and operations.

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CENTER FOR NAVAL ANALYSES

ECONOMICS OF LOGISTICS PLANNING
THE PLANNING PROCESS, PLANNING ELEMENTS AND PLANNING FACTORS

By Bernard A. Kemp

This study represents the view of the Center for Naval Analyses at the time of issue and does not necessarily reflect the official opinion of the Department of the Navy.

Prepared by the
Center for Naval Analyses
The Franklin Institute

ECONOMICS OF LOGISTICS PLANNING
THE PLANNING PROCESS, PLANNING ELEMENTS AND PLANNING FACTORS

The objective of the Logistics Research Conference is to determine the research that has been and has to be done in particular problem areas. One of the problem areas — Logistics Planning Elements — is the subject for discussion of Panel One.

There are a number of basic misconceptions, misunderstandings, and contradictions about the nature and use of Logistics Planning Elements. For example:

- (1) Although it is generally recognized that "accurate" planning factors are difficult or impossible to obtain, there has been little recognition of the causes for this difficulty and little recognition that inaccurate estimates can result in costly deterioration of mission performance.
- (2) Although there are occasionally recommendations that planning factors for attrition — the consequence of enemy action — be developed, there is almost no direct consideration of the implications of differing enemy strategies and tactics on the planning factors.
- (3) Planning factors are frequently treated as if they are independent of any budgetary or resource constraints. Consequently, no attempt is made to determine if the necessary amounts of required resources will be available. As a result, the operational commander may not be able to obtain the amounts of resources he expects on the basis of the planning factors, simply because the resources are not available in time or because other uses take precedence.

- (4) Although there is some recognition that resource constraints can limit operations, there is no general agreement that budget constraints can have the same effect. However the budget is simply a monetary representation of the actual resources.

In my view, to eliminate these misunderstandings and to determine what additional research is required in the problem area of Logistics Planning Elements, it is necessary to develop an appropriate framework — one which will relate the planning elements to the decision process. In fact the only reason for the existence of Logistics Planning Elements is to help in the management-operations decision-making process. Consequently, an understanding of the nature of that process will make it possible to place Logistics Planning Elements in their appropriate context and incidentally to provide an analytical framework by which to judge what additional information and research about Logistics Planning Elements would be helpful.

The Decision-Making Process

For any level of operations, the nature of operations and the decisions about them are basically the same. It involves choosing the "best" way of accomplishing a particular job or objective from among a number of different ways on the basis of some criteria. Each alternative involves different amounts of various kinds of resources — for example, time, personnel, various types of material and equipment, services, and facilities. Only those amounts of

resources which are available, or can be made available, can actually be used in the operation. A good decision-maker is one who, on the basis of factual information, knowledge of the workings of the system- experience and judgment, can choose the "best" way of using all available resources, especially when the "best" way is far better than the "second best".

As trivial as it sounds, the decision-maker cannot use resources which he does not have in an operation. Consequently, either the available resources limit the extent to which the objective can be accomplished or the desired level of the mission can be accomplished without using all the resources available. In the first case, selecting a "poorer" way of performing the operation results in a deterioration of the mission, either in quantity or quality. In the second case, a poor choice may not result in a deterioration in this mission but it will result in a deterioration of over-all system performance. When even a "better" rather than a "poorer" way of performing the same mission is adopted resources are released. The scarce resources which are released can be used for some other mission and its performance can be improved. Consequently, poor choices always result in less effective performance of the overall system.

An example will shed some light on the problem. Imagine the following situation on board a carrier in the Gulf of Tonkin. A mission is planned for the following morning but two aircraft in the squadron are currently down. The same electronic component is not operating in both of them and the aircraft cannot perform their mission without it. The defective components are on the workbench in front of the mechanic, and he is told to repair them and install them in time for the flight the next day. Let us assume that there is only one such component available in stock on board the carrier.

There are a number of ways to solve the problem:

- (1) He can go into each component, find the difficulty, repair or replace the broken part, reassemble the component, and install it in the waiting aircraft, hopefully in time.
- (2) He can do that with one of the components and replace the other with the one from stock.
- (3) If there is an aircraft of the same type which is down for some other reason, he can pull the component from it and install it and the stock component.
- (4) If a sister carrier operating in the same task force has an available component, he can have it ferried over and install both the stock components.
- (5) He can get an extra component delivered from the supply base at Subic Bay by the carrier-onboard-delivery (COD) system which, for the purposes of the example, we will assume is due to arrive an hour after the scheduled departure time of the mission.

These are just a few of the ways in which the problem could be solved. All of them are presumably equally good in that they accomplish the job, except that the last one would delay the start of the mission something over an hour. However each alternative is different in the amount and nature of the resources

required to accomplish this objective and perhaps in the probability of repairing both aircraft before the deadline for the mission. For example, since the time required to repair both components cannot be accurately determined beforehand, technique (1) may not meet the deadline. If it did, it has the advantage of making it possible to accomplish the mission and also have the new replacement parts in stock against future breakdowns. In contrast the repair job can be accomplished on time if the part is delivered from the other carrier and both stock parts are installed. But, this requires the use of resources involved in the shuttle delivery and neither component will be available next time.

In any event there is a choice among alternatives: one which will be made by the action taken and one which will probably never come to the attention of the decision-makers up the line unless the job is not successfully performed. Nonetheless, it is a choice and the system takes the consequence of that choice. If the mechanic is good and successfully repairs the parts, the mission goes off as planned. If he is not successful and did not leave enough time even to install the second part from stock, the mission will be delayed. The system must bear the consequences of whatever decision is made.

The choice which is "best" - and that is not always the one which is made - depends on the criterion. For example, putting in all new components - the engineer's dream - requires either running an extra shuttle (technique 4) or delaying the mission (technique 5). In either case these new components will not be available for future use and new complex components are not always better than proven ones. Another criterion would be to choose the technique which accomplishes the job at the least cost. When any one technique uses less of all resources than another, it is the better alternative. However when a technique uses less of some and more of another resource, then there is a trade-off and a decision problem. Sometimes it is possible to make these differences in the amounts of resources commensurable by using money costs. But here again, regardless of the criterion, the system must take the consequences of any decision which is made, even if the upper echelons of decision-makers do not become involved in the decision explicitly.

The high level decision-makers are likely to become involved if the mission is important; if there is a chance that the mission will not come off; or if in order to do the job more resources are required than are available. For example, if it is necessary to requisition the component either from the other carrier or make a special requisition to insure that it is on the COD aircraft, then a decision must be made at a higher level.

But even at the higher level, the basic nature of the problems are the same. The decision-maker must decide, or face the consequences of a decision, on the "best" way to perform his mission - which in this example involves getting a squadron of aircraft off at a particular time.

- He may be able to accomplish the objective with the resources he has available.
- He may be able to accomplish it if the mission is delayed a little, even an hour.
- He may be able to accomplish it if he gets additional resources, like the shuttle delivery of the component.
- He may be able to accomplish it with one less aircraft or by using all the planes in the squadron including one defective one.
- He may have to scrub the mission.

But the problems are the same, and the system takes the consequences of the method "chosen" to perform the mission.

These problems are also the same ones that must be faced by the next decision-making echelon where the decision is one of alternative ways of performing the mission objective; for example, using a land-based Marine squadron rather than the carrier-based squadron.

This example sounds similar to "For the want of a nail the war was lost," but both the parable and the example emphasize the basic interrelationship of a chain of jobs which affects the accomplishment of the overall mission. They differ in one important respect, however. In the example there are different ways of accomplishing the mission at each stage of the operation. The decision-maker must - implicitly or explicitly - choose among them. The alternatives are not simply "go" or "no go".

The decision-making process increases in complexity with the introduction of multiple objectives and/or more than one decision-maker, as in a committee or in a chain-of-command. However, the decision-making process remains basically the same. Military operations also introduce another complicating factor - an opponent

bent on preventing you from accomplishing your objective. To do this the opponent will introduce various tactical maneuvers. The problem, of course, is that the best countertactics require different amounts of differing kinds of resources. Although the decision-making problem is made more complicated by an opponent, basically it is not any different. The commander still must choose the best way of accomplishing his objective, given the resources that he has available. However, he must recognize that his opponent will do everything within his means to thwart the accomplishment of the mission. The basic elements in the decision process are present.

They are:

- o Determining the nature and level of the mission, and
- o the alternative ways of accomplishing the mission (i.e., determining the amounts of each of the various resources required for each technique), then
- o insuring that the resources are available, and then
- o selecting the "best" feasible way of accomplishing the mission.

The Planning Process

Each of these elements in the decision process is present, both in current and in future missions. The difference between them is simply that in future missions it is more difficult to know in advance exactly, or even closely, what values the elements will take on. For example, just how many avionics specialists will be

be required? But, future missions have a distinct advantage over current missions - flexibility. For a current mission, the decision-maker is committed to the resources available on the site. For a future mission, it may be possible to obtain additional resources. This can be done only at the expense of some other mission. In spite of the difficulty and because of the flexibility, planning is important. Without an attempt to predict each of these somewhat nebulous variables, fewer of the right kinds of resources will be available when and where they are needed. Good results in planning - i.e., making sure ahead of time that the mission is performed in the "best" possible way - requires an understanding of the decision process and of the nature of the problems to which it is being applied. It also requires accurate information about the system.

Each of the elements in the decision process is also an element in the planning process. In future missions it is necessary to establish the objective for the operation (or the mission or the job) and then to determine the alternative ways in which it can be performed. Each of these ways involves different combinations of the various types of resources. But, the only techniques which are feasible are those where the required resources will be available. Consequently, at every level of the operation, it is necessary to insure that the amounts of resources required to perform that

particular mission will be available at the desired location. This can be done only by insuring that all demands from all locations for each particular type of resource will not exceed the total amount of resources that will be available. Then among all feasible ways to perform the mission, it is necessary to choose the "best" way in the light of the preselected criteria. Thus, each element in the decision process has its counterpart in the planning process, although admittedly more difficult to predict.

It is just this difficulty - i.e., of making accurate predictions of the variables - which makes the planning process somewhat different than the decision process. A typical reaction to this difficulty is - since very accurate predictions are not possible, "ball-park" estimates are good enough. The main objection to adopting this approach is that errors in predicting any of the variables are not necessarily costless.

For example, assume that the estimate says that two squadrons of attack aircraft will be required to accomplish a mission and, in fact, two squadrons are provided. If, when it comes time to perform the mission, it is discovered that three squadrons are required, then there can be a deterioration in mission performance or even the necessity of scrubbing the mission altogether. If the mission is performed with only two squadrons, the total number of aircraft lost may be greater than if it had been performed with three squadrons. The "mistake" in estimating the amount of resources required clearly affects the performance of the mission and the amount of resources that would be available for future missions.

Although frequently overlooked, estimates on the high side also can be costly. If one squadron, rather than two, is actually required to perform the mission and if it is not possible to shift the second squadron to a more productive use, then the overall performance level of the system will suffer. This occurs because resources which could be available for use elsewhere lie idle at their current location.

In spite of the fact that each of the elements is difficult to predict, poor prediction has a cost, namely a drop in overall system performance. A cavalier attitude towards the difficulties of prediction does not avert these costs.

It is for these reasons that it is desirable to make predictions as accurate as possible; but, also to allow for a margin of error in the planning process. Planning to close tolerances in operations which are crucially dependent upon the availability of all the planned resources results in deterioration in mission performance when all the resources are not available. The lack of availability of resources can result in a serious deterioration in mission performance, especially when these resources cannot be provided from elsewhere without seriously deteriorating the overall performance of the system. At least planning should take this possibility into consideration. One way to do this is to provide the additional resources necessary to meet the difficulties, should they arise. This is just what is done in inventory management when both operating levels and safety levels are provided. In those situations where the difficulties are not serious - either because they are unlikely, or because the denial of the resources does not

result in a substantial modification in the mission, or because the resources can be pulled from elsewhere without seriously affecting overall system performance - providing additional resources to meet possible future contingencies would be unwise and costly. But in all other cases, an explicit recognition of the problem and an overt attempt to deal with it in the planning process will improve system performance.

One important technique to help solve this problem and one which might make it possible to hold fewer resources against these contingencies, is having an information system incorporated into the decision process. This information system would cue the appropriate decision-maker that something is going "wrong" and inform him of the amount of additional resources that will be required to make the adjustment. The sooner he is informed, the more flexible are the resources and the more likely it is that he can make a better adjustment. PERT is just one technique for accomplishing this objective. In addition if the decision-maker is informed when an operation is going "right" and how many of the resources are released as a result, then he can use these resources elsewhere in the system.

Planning and decision-making are much the same. The elements and the interrelationship of those elements - the process - are much the same. Good planning requires going through each step in the

planning process and at each step making the best estimates possible, recognizing that they cannot be perfect. At the other extreme, leaving the problem to chance and ad hoc solutions may accidentally give rise to the best performance in some cases, but it certainly does not always lead to that favorable result. The intermediate approach, casual "planning" is not likely to work well when refined prediction is possible and when it substantially improves system performance over the unaided judgement of system managers.

Planning Factors

As part of the planning process, any planner must determine the amounts of the various kinds of resources which will be required to perform the specified level of the mission. This function is the one which is performed by using the classic planning factors. The planning factors typically are a single-valued estimate of the amount of each of the resources required to perform the mission. But, in view of the discussion above, it is clear that each of the ways in which the mission can be performed requires its own amount of each of the resources. These amounts may differ significantly from one technique to the next. Typically, these differing combinations of resource requirements are not taken into account in the planning factors.

At their very best, planning factors tell the quantity of the resources which were in fact required (or were required on the average) when the particular mission(s) was performed at a time in the past. The use of the planning factors implicitly assumes: (1) the past mission(s) was performed in the "best" possible way, i.e., that it could not have been done with fewer resources or that somewhat more resources would not have improved the mission performance substantially; (2) the conditions which determined the resource requirements for the particular mission in the past will prevail next time or, at the very least, that changes in these conditions will not, result in a significant change in the amounts of the resources required; and (3) the data collected at the time of the mission(s) accurately reflect the amounts of the resources that were used. In summary the use of the planning factors involves the implicit assumption that if the mission is run again, the objective of the planners is to run the mission exactly as it was run in the past.

A better understanding of the problems involved in developing and using planning factors will result in a clearer understanding of the nature of planning factors and their place in the planning process. As part of an attempt to estimate the amount of ship propulsion fuel required in the first 75 days of wartime operations, old planning factors were reviewed and new ones were developed.

Requirements Estimates for Ship Propulsion Fuel

The previously existing techniques for estimating ship propulsion fuel requirements used gross variables. The planning factors gave the average number of barrels of fuel per day that would be consumed under wartime conditions for each of the broad types of ships. Once the number of ship days these ships would be available was determined, it was possible to estimate the fuel required.

With the advent of equipment which could handle large quantities of data, it became possible to develop a more sophisticated technique. It involves:

First, determining the ship composition of the fleet or task force during the period;

Second, based on preassigned missions, estimating the amount of time that each ship will be steaming at each speed - the time-speed patterns; and,

Third, estimating the amount of fuel that will be consumed at each speed - the fuel consumption curves.

The expectation is that the more detailed data should provide the basis for making more accurate fuel requirements estimates.

While the original technique had the advantage that it made the computations simple, it had a number of serious disadvantages

that are typical of many of the planning factors. First and foremost it did not take into consideration a number of very important variables, which significantly influence both actual and estimated fuel consumption. This estimation technique was invariant with respect to the mission and type of employment; to the speed at which the ships operated, a critical variable; and to the class of ship within the type, when fuel consumption among classes differs widely. Moreover, the fuel consumption curves which provide a basis for the consumption factors were suspect because they were derived from average fuel consumption over an extended period which included time in overhaul; because changes in the ship characteristics made the basic source data outmoded; and because the original data was based on particular patterns of missions, of tactics and on ships which no longer exist. The missions and tactics which depended upon the particular threat and the fleet composition, at that time, may not have been the "best" way to operate then and almost certainly are not applicable to future operations.

In short, the planning factors usually did not apply to the situations for which they were being used and even when they did they were inaccurate. But most important of all, although the evidence is not very good and was not systemically collected, it leads to the conclusion that the existing planning factors generated inaccurate estimates.

The "new" approach was designed to correct some of these shortcomings. As a part of this approach, it was decided that each of the three detailed data inputs should be provided by the cognizant commander or activity because he has the responsibility and is most familiar with the problem. Specifically:

- (1) CNO specifies the missions and composition of the fleets;
- (2) The Fleet Commanders estimate the time-speed patterns; i.e., the amount of time which each of these forces spends at each particular speed in accomplishing the missions;
- (3) The Bureau of Ships estimates fuel consumption curves; i.e., the amount of fuel the ships use at each speed.

Accurate estimates of fuel requirements are possible only if it is possible to obtain data which provides "good" estimates of each of these data inputs. In attempting to use the "new" planning factors to estimate fuel requirements for the first 75 days of a War, a number of important problems developed which made good fuel requirements estimates difficult to obtain.

A review of some of the difficulties which were encountered in attempting to develop and use these factors provides some insights

into the nature and usefulness of planning factors and their part in the planning process.

Insights into Planning Factors

In the planning process, it is essential to isolate the variables which cause variation in the required amounts of the resources. The study clearly reveals that small variations in the time-speed patterns result in very large variations in fuel consumption. Similarly, differences in the fleet composition, especially of the large ships, affect fuel consumption markedly. Unless it is possible to make realistic estimates of the time-speed patterns and of the fleet composition beforehand, the requirements estimates are likely to be inaccurate. Planning factors which do not account for variations in these essential factors are likely to lead to inaccurate estimates of the amounts of the resources required.

The study found that the class of ship to be transferred from one fleet to another and the date of that transfer (the chop date) were inaccurately estimated. An important contributing factor was the lack of detail in the scenarios and the plans which implement them. Double counting occurred during the period when one fleet commander picked up a ship before the other commander chopped it out. Moreover, the ship that was picked up was of a different class than the one chopped out. This discrepancy is of considerable importance

in those cases where fuel consumption varies widely among classes within a type, as it does between CVA 19's and CVA 41's.

This lack of detail may be both necessary and desirable for operational purposes, but it causes serious errors in fuel requirements estimates. Ambiguity, and the consequent lack of detail, may well be necessary in planning fleet operations when it is impossible to know the class of the ships that will be available for transfer or exactly when they will be available because the crisis if it occurs, will occur at some indefinite time in the future. On the other hand, blind adherence to current plans for transferring forces will virtually guarantee that the wrong forces will be in the wrong places at the wrong time. At most, authoritative sources provide the current "best guess" about the shifts that will be required in the event of emergency. However, this "best guess" will almost certainly not be matched by actual experience. But when the general provisions in the planning documents are interpreted differently by each fleet commander, inaccurate fuel requirements estimates will certainly result.

Analysis of the study data and supplemental investigations strongly suggest that the estimates of the time-speed patterns

which were submitted are unrealistic, even when the mission (the output) and the detailed composition of forces (the amounts of some of the other resources) are known. The estimates are less realistic when these important variables are unknown.

In part the lack of realism in the time-speed patterns is due to the lack of detail in the scenarios in the appropriate planning documents. This lack of detail may be necessary and desirable in the face of alternative enemy strategies, but it leads to inaccurate requirements estimates when the requirements are sensitive to differences in certain variables - as in this case, where fuel requirements are sensitive to the time-speed patterns. To overcome deficiencies in the scenarios, it is necessary to make extensive and fairly detailed assumptions. If the results are sensitive to these assumptions, wide variations in the requirements estimates can result. Our study emphasizes that care must be exercised in selecting the assumptions and in making sure that all those individuals responsible for submitting data interpret the assumptions and the scenario alike.

In summary knowing the nature of the mission and the alternative ways of performing it is a necessary prerequisite for accurate fuel requirements estimates and an essential part of the planning process.

This information should be provided by the scenarios or incorporated into the explicit assumptions. Unless the factors which cause variation in the requirements estimates, (i.e., the technical relations) are known and the scenarios provide adequate information about those factors, inaccurate requirements estimates will result. Moreover, unless the scenarios and assumptions are understood in the same manner by all those providing data for the estimates, inconsistencies and inaccuracies will result. It is possible to make accurate estimates of the amounts of the various types of required resources only when the mission, and when the factors affecting the accomplishment of the mission, (i.e., the alternative techniques) are known. Good, well understood scenarios help to accomplish this part of the planning process.

In the process of conducting the study, no attempt was made to generate alternative ways of performing the mission and selecting among them. Consequently, the implicit assumption was made that all the ways of performing the mission were examined and that the best one was selected. When a non-optimal technique is chosen, either deliberately or accidentally, more resources are committed to this mission than are needed to perform it. These resources could be used elsewhere.

In addition the study revealed that knowing the missions and the technical relations is not sufficient. It is necessary to reconcile the total demand for the resources with those that will be available. Accurate fuel requirements estimates must be made on the basis of the best available information on the total forces which will be available. All ships that will be available should be included in the problem; those which will not be available should not be included. In estimating fuel requirements for the study, it was found that the same ships were included in the original data submissions of more than one fleet commander, each of whom made independent data submissions. This problem was eliminated by reconciling the data submissions with authoritative sources on force levels. But it is impossible to make definitive estimates of future total forces or the forces which will be available to each fleet commander beforehand. The emergency, if it occurs, will occur at some indefinite time in the future when the composition of forces will be different, although perhaps not much different, than it is now. Almost certainly it will differ from the current "best guess". Regardless of the accuracy of the estimate of the total amount of resources available, some attempt should be made to insure that only those resources which will be available are included in the planning process.

The study showed that in the planned process it is necessary:

- (1) to specify the mission clearly
- (2) to understand the factors which determine the amounts of the resources required and the relationship among those factors (the amount of each of the resources required is synonymous with the alternative ways of performing the mission)
- (3) to insure that the demands for any particular kind of resource - either on the site or in the organization or in the system - will not exceed the amount of each resource available.

More on the Nature of Planning Factors

In spite of the attempt to improve the quality of ship propulsion fuel requirements estimates, the ones based on the improved technique are still likely to fall wide of the mark. An improved understanding of the nature of planning factors will reveal some of the causes of this inaccuracy.

Part of the lack of correspondence between actual and estimated fuel requirements is the result of variability in the actual fuel consumption. The best available evidence indicates that repetitive reruns of a particular mission by the same ships would result in

considerable variation in observed fuel consumption. Changes in the output (i.e., the mission) or in combinations of associated inputs (e.g., the composition of ships) would cause even greater variation in the actual fuel consumed - the particular input under study. With considerable variation in the actual fuel consumed, the consumption of any one run of the mission may be far from the average.

Similarly reruns of the estimating procedure or the use of other estimating techniques or estimating inputs will almost certainly result in a distribution of possible values; i.e., a range in estimated fuel consumption.

Moreover, the distribution of estimated fuel consumption may differ from the distribution of actual fuel consumption. At the extreme the two distributions may not even overlap. When actual fuel consumption can vary widely, a "good" estimate of the amount of fuel that will be consumed cannot be single-valued, i.e., a statement like x barrels of Navy Special Fuel Oil will be required for this mission. Even if actual fuel consumption were single-valued (i.e., even if repetitive reruns were possible and they resulted in the same fuel consumption), unless the existing technique can discover that value beforehand the single-valued estimates of fuel are not likely to be "good". Single-valued estimates are likely to

deviate, and perhaps substantially, from the actual fuel consumption.

Good fuel requirements estimating techniques are those which generate an estimating distribution which is like the distribution of actual fuel consumption.

To discover the techniques which will lead to good estimates of the amounts of the resources required to perform a well-defined mission, it is necessary to determine the variables that influence actual consumption and their interrelationships. For estimating fuel consumption it is not sufficient simply to know the types of ships and the number of days they are available. Some knowledge of the speed profile and the fuel consumption curve is essential also. Simply isolating these variables is not enough. For example, it is well-known that speed affects fuel consumption. The important factor is the specific relationships among the variables; for example, the amount of fuel consumed at each speed for each class of ship - the fuel consumption curves. These relationships are often functional and/or stochastic in nature. They are the technical relationships and can be considered the "invariants" in the system in the sense that any decision-maker must take these relationships into account or suffer the consequences.

In estimating the amount of any particular kind of resource which will be required, it is necessary to take into consideration the amounts of the associated inputs that will be used in the mission. There are two types of associated inputs: complements and substitutes. In the case of Navy Special Fuel Oil, an example of a complementary input is ships; an example of a substitute input is JP-5. For complementary inputs there is a direct relationship between the amounts of the inputs required; that is, the larger the number of ships that are available the greater is the amount of fuel required. For substitute inputs there is an inverse relationship between the amounts of the inputs required; that is, the larger the amount of JP-5 that is available as ship propulsion fuel, the smaller the amount of NSFO required. Consequently in estimating the amount of a particular input, like NSFO, it is necessary to simultaneously estimate the amount of associated inputs because any change in one is accompanied by a change in the other. If the decision-maker is provided with a schedule of the amounts of these inputs, then he has available to him the trade-offs which constitute an important part of the alternative ways of performing the mission.

A Way Toward Better Estimates

One way to improve the quality of the estimates would be to design and run experiments to determine the functional and statistical relationships between important variables; for example, the relation

between missions and the time-speed patterns. Another procedure would be to investigate the impact of changes in the scenarios or assumptions on the important variables directly. With a data processing program, like the one developed by the study for making ship propulsion fuel requirements estimates, it then becomes possible to study variations in the scenarios and the assumptions directly. In many cases, an accurate determination of these planning elements of the system can be obtained by careful, open-minded quantitative study or by well-conceived, well-executed experiments - either in exercises or in other non-wartime situations.

Requirements Estimates and the Planning Process

In short, accurate estimates of the amount of the inputs necessary to perform even a well-defined mission (the output) require a determination of the variables that influence actual consumption (like the time-speed patterns and fuel consumption vs speed curves) and a determination of their interrelationships in the performance of the mission. With these "invariants" it will be possible for a decision-maker to have a schedule which tells him the amount of fuel that would be required to perform this mission for various amounts of time. For example, if you want to perform the mission in 10 days, with two ships, it will require between 400,000 and 500,000 barrels. If you want to perform

the same mission in 11 days with the same two ships, it will require between 375,000 and 450,000 barrels of fuel. On the basis of this information the decision-maker can choose the best of the alternative ways of performing a mission and evaluate the cost of the mission - i.e., the foregone alternatives. Even without this information, he is still choosing among these same ways.

Any estimation, by simulation or otherwise, which treats these relationships as non-stochastic and/or nonfunctional will result in inaccurate estimates of the inputs required to perform a mission and consequently in inaccurate estimates of the resource and monetary costs of performing the mission. Only with this information available is it possible to make accurate estimates of the resource and monetary costs of performing a mission. Then the "best" method of performing the mission can be decided on the basis of an objective appraisal and not left to chance alone.

Moreover, the recognition of the possibility of variation in the quantity of a particular resource requirement makes it possible to directly attack the problem of what level of that resource requirement should be met and stocked. For example, a decision must be made whether to provide x barrels of fuel which would be enough fuel 95% of the times the mission is run; or whether to provide y barrels which would cover the mission 94% of the time and

() to slow the mission down in order to make up for the difference in fuel. This is really the important question of what would happen to system performance if a little more or a little less of that resource were available. This is an important decision whether it is made explicitly or implicitly. This approach avoids adopting the rigid attitude which says "we need x barrels", an attitude which can be costly when x barrels are not available.

() The selection of a mission is exactly the same type of problem for the next level of decision-makers. In this case, alternative missions are the input. However, accurate data are even more difficult to obtain because a greater number of variables confront the decision-maker and they are more difficult to quantify and estimate.

Once the "best" or any other way of performing a mission is selected or once the mission is chosen, then the amounts of each of the resources required is known. If the resources are not in the system, it is necessary to pay the delivered price to have these resources on site. If they are in the system, the cost of using them for this mission is equal to their value in the best alternative mission, (the mission which is given up because they are used in this one). One way to estimate that cost is to use

the replacement cost of the resources, i.e., the delivered price. Consequently the selection of the way the mission is performed, along with the delivered price determines the budget. If the amount of money specified by the budget is not made available then all the resources will not be available and the mission will not go off as planned. If the mission was planned in the best possible way there will be a deterioration in it. If the planned mission was not optimal, then by revising the plan it may still be possible to perform the mission, but this could have been done beforehand when the flexibility to decide on the "best mission" still remained. Any unplanned changes in the resource requirements or in the delivered prices of those resources, which occur after the budget for the mission is determined, have a similar effect on the execution and performance of the mission.

Hopefully the relationships are not like the ones found in the estimation of ship propulsion fuel requirements - ones where the fuel requirements are very sensitive to the speed and where good estimates of the speed are virtually impossible to determine beforehand. But if the variables are of this nature, then these facts must be accepted and the decision-maker must make his choices in this context. Assuming or acting as if they were different is fraught with peril because it will lead to the wrong amount of resources being available at the wrong place at the wrong time.

() If the required resources were not available, there would be a degradation of mission performance. If more than the necessary resources were made available, there would be a degradation in overall mission performance if these resources could have been used to better advantage elsewhere.

() Once it is recognized that actual and estimated fuel consumption will vary, the desirability of having a procedure for determining when the actual consumption is deviating from the estimated consumption and having a flexible support system which can rapidly adjust to the new requirements becomes evident. Requirements are not fixed. Planning as if they were rigid is costly and leads to unnecessarily poor performance. Recognition of the variation and an attempt to determine its causes will improve system performance. This approach will make it possible not only to determine the amounts of the various inputs which may be required, but also to develop a system which will make adjustments possible if more or less of the input(s) are required.

In Summary

() Good planning requires an understanding of the planning process (i.e., the application of the decision-making process to future decisions). Planning is likely to be inaccurate: (1) if any step in the planning process is omitted, or (2) if there is inadequate

understanding of the factors which determine the amount of resources required or of the nature and implications of variations in the amounts required or in the causes for that variation. Planning factors which are used to make these estimates but which do not give these problems adequate consideration will lead to inaccurate estimates. Inaccurate estimates of the amount of the inputs required or available will inevitably lead to a deterioration in the performance of the overall system. Low estimates will result in too few resources available for this particular mission. High estimates, while providing more than enough resources for the particular mission, will result in too few resources for other missions since there are always limits on the amounts of resources which are available from the private sector of the economy. Accurate planning will improve system performance. Accurate planning requires good factual information, knowledge of the workings of the system, experience and judgement. In those cases where research can substantially improve our knowledge of the amounts of resources that will be required and available and/or our understanding of the factors which influence the amounts of resources required or available, it will substantially increase planning accuracy and system performance. But improved knowledge of the system obtained through research is not enough. The decision-makers must have an understanding of the planning process and the nature of the planning elements and must apply this knowledge in planning.

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LOGISTICS PLANNING ELEMENTS

LONG RANGE PLANNING

1. The purpose of this paper is to examine the logistics planning in the USAF, indicate certain changes in logistics capabilities that will be required to satisfy conditions that will exist in the 1965/1975 time period, and finally to point out some areas in which logistics research can and should be applied. The Air Force Logistics Command at Wright-Patterson AFB seldom embarks on pure research studies to refine or change logistic procedures or policies; instead, evolutionary changes are made through constant and comprehensive general-type studies. Hence, to be of optimum benefit to the panel members, I shall digress, somewhat, from the standard format.

2. (CHART 2) The spectrum of factors involved in long-range logistics planning is extremely wide.

a. The future logistic system must be designed to satisfy conditions imposed by factors over which the logistic system has no control. They are:

- (1) Changes in the force structure to be supported.
- (2) Changes in the threat posed by the Communist Powers.
- (3) Changes in strategic, tactical and defense operational concepts for both peacetime operations and for war.
- (4) The emphasis being placed by the Office, Secretary of Defense on integrated logistics management.
- (5) The recent adoption of the DOD program management concept as a technique for evaluating the cost/effectiveness of proposed and approved programs.
- (6) The future economic constraints.

(7) The technological advances that will occur in the tools of logistics.

(8) In addition, some changes to the system are needed for the resolution of problems currently being experienced.

b. A thorough review of the foregoing factors, would lead one to conclude that long-range logistics planning could be studied from two different frames of reference:

(1) First, external factors, such as the DOD integrated management concept, would permit planning with respect to logistic roles and missions. Such planning requires the planner to proceed from a DOD frame-of-reference.

(2) Second, the logistic system consists of several hundred processes that are inter-related. Planning could be accomplished to determine whether current problems or the evolving external influencing factors require any change in the logistic concepts. This planning requires the planner to proceed from an Air Force frame-of-reference.

c. (CHART 3) The fact that there are several hundred logistic processes can be illustrated:

(1) Logistics is commonly thought of as consisting of a number of functions, such as procurement, maintenance, transportation, communications, supply, etc.

(2) The function of supply actually consists of a large number of operational systems, such as cataloging and inventory control.

(3) Each operational system in a functional area consists of a large number of processes. For example, the operational system of requirements employs a different process for computing Hi-Value item requirements than is used for Cost Category II, recoverable items. Those, in turn, are different than the process that produces materiel stratification or definitization of war reserve materiel needs.

(4) Planners are confronted, therefore, with the task of determining whether changes should be made in the logistic concept underlying each of the processes.

3. As previously stated, there are a series of factors external to the logistic system which influence the characteristics which the logistic system should possess.

a. (CHART 4) One of these factors is the threat expressed in terms of the levels of war intensity which the logistic system must be capable of supporting.

(1) During the past decade, the logistic system was required to provide a capability for supporting two types of war. One type of war was referred to as a limited war, which would be a way of relatively low intensity. The second type of war was the nuclear holocaust.

(2) Project FORECAST described the spectrum of wars for which capabilities are required during the next decade. The future logistic system must be capable of providing sustained support to counterinsurgency operations, a conventional war, or a counterforce war involving the highly selective use of nuclear munitions. In addition, it is necessary to maintain the high state of operational readiness required to prosecute a counter-value war, i.e., the application of total military capabilities. The most important logistic consideration in this concept of war is the requirement for a capability of providing sustained support below the counter-value war level.

b. (CHART 5) The future force structure will be reduced in terms of its size. Throughout the decade, the force will continue to be comprised of aircraft, electronic systems and missiles. The systems will be more complex than at present, and this factor will tend to offset the reduction in size and thereby stabilize the resulting logistics workload.

(1) There will be an increasing number of program elements, i.e., weapon system which are employed for multiple missions.

(2) During the latter years of this 1965 - 1975 decade, there may be Air Force manned space operations. It will be impossible to conduct the research and development necessary to produce the logistic concepts and standardized equipment applicable to space operations, until a program describing the general characteristics of these systems is published.

c. (CHART 6) During the next decade, the rate of technological advancement in logistic tools will exceed that of the past decade.

(1) Direct voice input to computers should become available before 1975. This development will permit major changes in reporting techniques. During this decade, low cost cathode ray tube and television tube data output capabilities will permit the direct support of operating personnel requirements for information. Equipment will have a very high level of reliability.

(2) Maintenance diagnosis will be greatly improved by availability of both internal and external automatic check-out equipment. This equipment will reduce workload and weapon system out-of-commission time.

(3) Further developments in high speed communications will allow the interconnection of bases, command and control headquarters and supporting logistic elements. Direct computer connections between all of these elements will be possible. The logistic system will have direct real time access to all available data in the total system.

(4) Major improvements in logistics software, i.e., system understanding and design will become available through the use of mathematical models, cost/effectiveness evaluations and the potential for systems evaluation.

(5) The introduction of long-range cargo aircraft, with high payload capacities, will enhance deployment and logistic support capabilities.

d. (CHART 7) The recent adoption of the program management concept will necessitate a reorientation of logistic management systems.

(1) This concept organizes the total DOD program into nine (9) major program packages - the strategic retaliatory package, the continental defense package, etc.

(2) Each package is broken down into the program elements. This breakout permits an analysis of the cost/effectiveness being experienced for each weapon system. The concept requires that plans, programs, budgets, funds and accounts be maintained by program elements, i.e., by weapon system. If a weapon system is employed in more than one program package, it will constitute more than one program element.

e. (CHART 8) Past experience clearly reveals that resources are always limited in comparison with total logistic requirements. Most likely, future constraints will be more severe than those of the past. Logistic plans must provide concepts for processes which optimize total Air Force capabilities within the funds appropriated.

4. In view of the foregoing, it becomes necessary to limit our discussion to a small number of significant areas which appear to cause major changes in our thinking. One other consideration is to discuss those subjects which have greatest interest to the members of this group. Because of these things I would like to briefly discuss:

- a. Automation.
- b. Integrated Logistic Doctrine.
- c. Logistic Planning.

5. (CHART 9) Automation remains in a state of rapid development. Key developments of interest to Air Force logistics planning are:

- a. First, that opportunity exists for employing data to increase the productivity of men, weapons, equipment, spares and facilities.
- b. Second, the Air Force is the world's largest computer user and has applied automation to a wide range of applications.
- c. Third, new technologies hold promise for early operational employment, i.e., direct voice input, CRT displays of selected data, time-sharing and low cost bulk storage.

6. (CHART 10) Future data automation capabilities should be exploited to:

- a. Facilitate the evaluation of policies at the Headquarters USAF level.
- b. Maintain a bank of information required in connection with initial support planning.
- c. Provide a basis for a continuous evaluation of major command concepts.
- d. Provide real time monitoring of virtually all aspects of wholesale level logistic support.

7. (CHART 11) It is believed that the USAF should take the following actions:

- a. Initiate development projects to capitalize on technology available in the 1970 - 1975 period, including the starting of an education program.
- b. Issue a system development guide.
- c. Generate maintenance data from automatic check-out equipment (ACE).
- d. Put into operation a system that provides direct access to the manager of all essential data.

8. (CHART 12)

a. A review of the DOD logistic concept of integrated management indicates that it overshadows all problems and all estimates of future factors which influence the design of logistic concepts and processes. This DOD concept concerns the military services' logistic roles and missions.

(1) (CHART 13) A brief review of the history of integrated logistic management tends to clarify the problem. The military services have gradually been relieved of certain responsibilities. These responsibilities are of two types.

(a) The Federal Catalog Program and the Military Standard Requisitioning Procedures are examples of losses in responsibility for specifying the procedures which the services will employ to perform certain processes.

(b) The establishment of several single managers and their subsequent reorganization under the Defense Supply Agency are examples of losses in responsibilities for specifying procedures to be used as well as responsibilities for performing the processes. The fact that the DSA has over 800 military personnel and approximately 31,000 civilians provides an order of magnitude indication of the reduction that has occurred in the military services logistic mission.

(c) The reference to the F-4 and F-111 aircraft indicates that a form of integrated management called "Single Service Management" is to be employed for support of these aircraft. The Air Force, in these instances, is the single service operational logistics manager. The problem in this concept is one of determining the degree to which one service should support another. There are advocates of the concept that the Air Force should perform all logistic processes and support Navy activities just as if they were assigned to the Air Force.

(d) Reference to Project 60 alludes to the Secretary of Defense decision to integrate certain of the military services contract management functions. Responsibility for integrating these functions has been assigned to the DSA. Integration of the functions has been completed in the Philadelphia region. Ten (10) other regions will be integrated in 1965. There has been some speculation that a new DOD agency may be established to manage the eleven (11) regions once the DSA has completed their integration. The Air Force would contribute approximately 9,000 personnel to this integrated management agency.

(e) At present, the military services are cooperating with both the Office of the Secretary of Defense and the DSA in completing a series of studies treating with many facets of logistics not heretofore studied:

1. The OSD Aviation Study is designed to determine the extent to which the military services depot level maintenance and supply warehousing functions could be integrated. This study will result in action to consolidate workloads into preferred facilities without regard to service jurisdiction. The study may lead to a phase-out of some of the services' facilities.

2. The Aeronautical Materiel Management Study was designed to determine whether logistics management of aircraft engines, engine parts and related accessories should be integrated. The study was completed and a decision to leave management with the services was made. The study indicated that there were major problems being experienced in the interservicing of assets. The services have undertaken a program to resolve these problems. It must be presumed that if the services are unable to demonstrate major progress in resolving these problems, the Secretary of Defense will reconsider the feasibility of integrated management.

3. The Materiel Utilization Study is similar to the Aeronautical Materiel Management Study except for the fact that it embraces 240 Federal Supply Classes not heretofore studied.

4. The Interface DSA/Services Study is designed to determine whether the DSA can now assume additional responsibilities for management of materiel already assigned to the DSA.

5. The Item Management Coding Study is designed to determine whether the services have coded items for services' management which could as readily be managed by the DSA. The Air Force, at present, is managing approximately 325,000 items that were coded out of the classes assigned to the DSA.

6. Another study is underway to standardize the provisioning process within the DOD.

(2) (CHART 14) The history of integrated management provides an estimate of the current situation.

(a) Generally speaking, the services have objected to every proposal to integrate a facet of their logistics systems.

(b) The Secretary of Defense has not disapproved any proposal and has approved most proposals to integrate logistics.

A decision on some proposals has been deferred as was the case with the Aeronautical Materiel Management Study.

(c) In the absence of fundamental principles (comprising a logistics doctrine), the Air Force has no sound basis for either supporting or opposing a specific proposal to integrate a facet of its logistics system. Some of our officers may suggest that some of the decisions to integrate were sound. In any event, the logic of the services' position urgently requires a re-examination in light of the numerous studies now in progress.

(3) (CHART 15) A general review of logistic processes reveals that they may be classified by the level of management involved in performing them.

(a) The processes involved in planning, programming, budgeting, requirements, inventory control, the making of engineering decisions and funds control require the manager to be responsive to the operational program objectives of the services' program elements. These processes are properly referred to as logistic program related management processes.

(b) The processes of cataloging, procurement, warehousing, maintenance, accounting, data services, etc. are, in the main, managed without direct reference to the operational program objectives of the supported program elements. These processes are properly classified as "logistic operations management processes."

(4) (CHART 16) There is an inter-dependence between military operational capability and logistics:

(a) The program related logistic processes are those in which decisions are made which tailor logistic support capabilities in a manner designed to achieve the operational objectives of the services' force structure. Responsibility for management of these processes cannot be delegated to a sister service or to some other agency.

(b) The logistic operations processes may be delegated, provided such action produces savings, and provided the risk taken by such delegation does not produce an unacceptable hazard to military operational capabilities.

(5) (CHART 17) This concept may be stated as elements of logistic doctrine.

(a) Program related logistic processes must be performed by the service which is responsible for the resulting military capability.

(b) Logistic operations processes may be performed by an agency external to the service responsible for the resulting military capability. Such support, however, must be assured, commensurate with the degree of hazard that non-performance would entail.

(6) (CHART 18) It is felt that action should be taken to immediately enunciate Air Force doctrine, clearly establishing the limits and conditions to which integrated management will be subscribed. Further, that action be taken to cause the military services to jointly adopt this doctrine. Action should then be taken to cause the Secretary of Defense to subscribe to and enunciate this doctrine. Until this is accomplished, there can be no effective long-range logistics planning by the services.

9. (CHART 19) Now, a quick look into logistics planning itself. Logistics Planning is one area in which research is badly needed. We should have a set of attainable long-term planning goals to meet future commitments. Due to the complexities of logistics planning, and only a few have been talked to in this paper, one wonders whether or not any change should be made in the emphasis placed on, or organizational arrangements made for, accomplishing logistics planning within the Air Force.

a. (CHART 20) Again looking at the overall spectrum of logistics planning, notice that the planner is confronted with postulating whether changes should be made to hundreds of individual processes, and if so, what these changes should be. Only by establishing specific time-phased goals with respect to each of these processes can a capability be created for forecasting future years' needs for men, equipment and facilities.

b. (CHART 21) Recent years have witnessed the emergence of numerous high level organizations external to the Air Force who are engaged in logistics planning. The Logistics Management Institute, the Defense Supply Agency analysis staff, the General Accounting Office, the OSD and others are studying individual logistics processes out of context with the total spectrum with which logistics planning must treat.

c. (CHART 22) Unless the Air Force is to abrogate its system design responsibilities, it must establish a logistic system planning organization that is second to none. This organization must develop logistics doctrine, policy, concepts and procedures. Because of the magnitude and complexity of the task, it will be necessary to employ the most qualified talent available within the Air Force and, in addition, utilize such assistance as can be obtained from Universities and Industry where appropriate. I believe this goal should be accomplished immediately, if in fact

it is not already too late. Conferences of the type we are in now could do much in bringing the problems of logistic planners into sharper focus, thus allowing research to provide answers more quickly.

10. In conclusion, you have seen some of the logistic processes and systems as the Air Force looks at them. The challenge to planners to improve their products has never been greater than now. Planners can and do have a great impact on the world around us, as an example of this let me cite the following which, incidentally, is one of the few pure "research" tasks undertaken by Air Force Logistics Command.

a. In 1962 General LeMay recognized the need to improve the survival and reconstitution posture of the U.S. Forces and logistics in the event of an all out surprise nuclear attack on the CONUS. This command subsequently developed a highly sophisticated war game to provide a sound estimate of the situation with respect to CONUS airfields, national petroleum resources, military installations and other resources totaling 7,500 locations or resource points. The time under consideration was 1 July 1965.

b. Initially a working group was formed composed of highly skilled technicians in the fields of mathematics, logistics, data processing and computer programming. Contact was made with the Office of Emergency Planning, National Resources Evaluation Center, the Office of the Joint Chiefs of Staff, Federal Aviation Agency, the Department of Interior, the Department of Defense and others to obtain from each selected elements essential to the development of the desired product.

c. The major characteristics of the game included five (5) elements:

(1) First, a list of potential CONUS targets was required. These were obtained from the NREC and included six (6) JCS attack options used for a 1963 wargame.

(2) Second, size of weapon and the CEP to be used against each target.

(3) Third, the latest national intelligence data on projected number of weapons and carriers was developed.

(4) Fourth, negation probabilities were developed for each type of weapon delivery. This was a composite of abort rate and U.S. kill probability.

(5) Fifth, included prevailing seasonal winds used to determine the effect on fallout.

d. With the use of an 1105 computer, the Monte Carlo technique was applied to determine for each location/point the overpressure and radiation dose rate probability for two attack phases; Phase I Missiles only and Phase II Missiles and Aircraft combined. A Phase III product ranked these locations/points in order of probability of survival or availability. Trial attacks were run 100 times on each of the locations. At a cost of \$116,000, twelve volumes consisting of 100 books were published and subsequently distributed to Headquarters USAF and each major air command. They in turn used it to validate/invalidate previous selections made for dispersal and regroup of their aircraft, material and personnel in a nuclear environment. As a result of this study, AFLC was able to make sound logistics decisions such as: concept of logistic support required in the environment, selection of sites from which to implement the support concept and procedural refinement to fit the situation.

11. One other indispensable tool to the logistician is simulation. It can prove cheaply that an expensive process is feasible. Because Dr. Murray Geisler has a sub-panel on this subject, I will not cover it in any detail except to say that it is incumbent on all planners to understand and appreciate what simulation can do in assisting them.

LONG-RANGE Logistics Planning

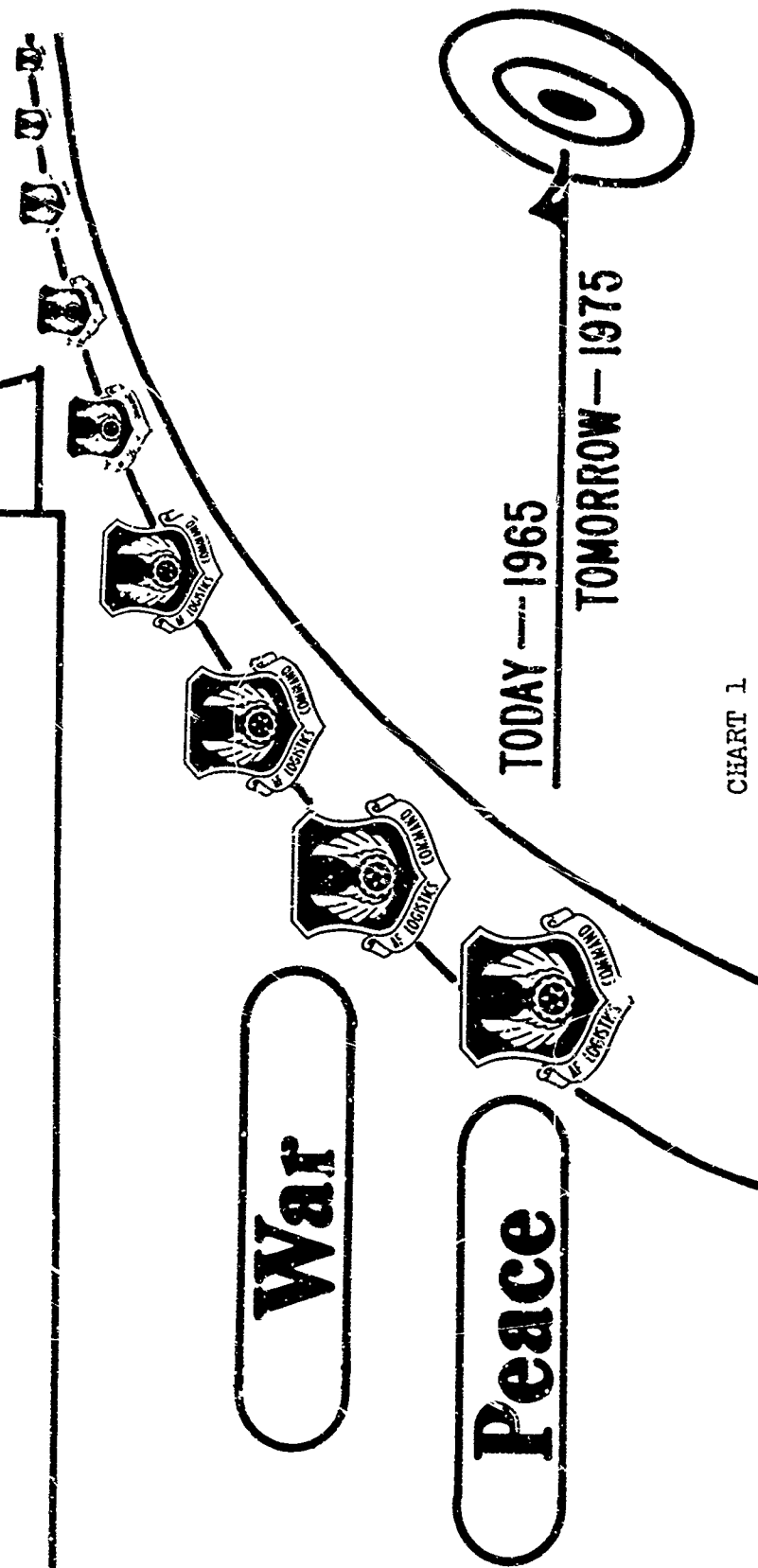


CHART 1

THE SPECTRUM OF LOGISTIC PLANNING

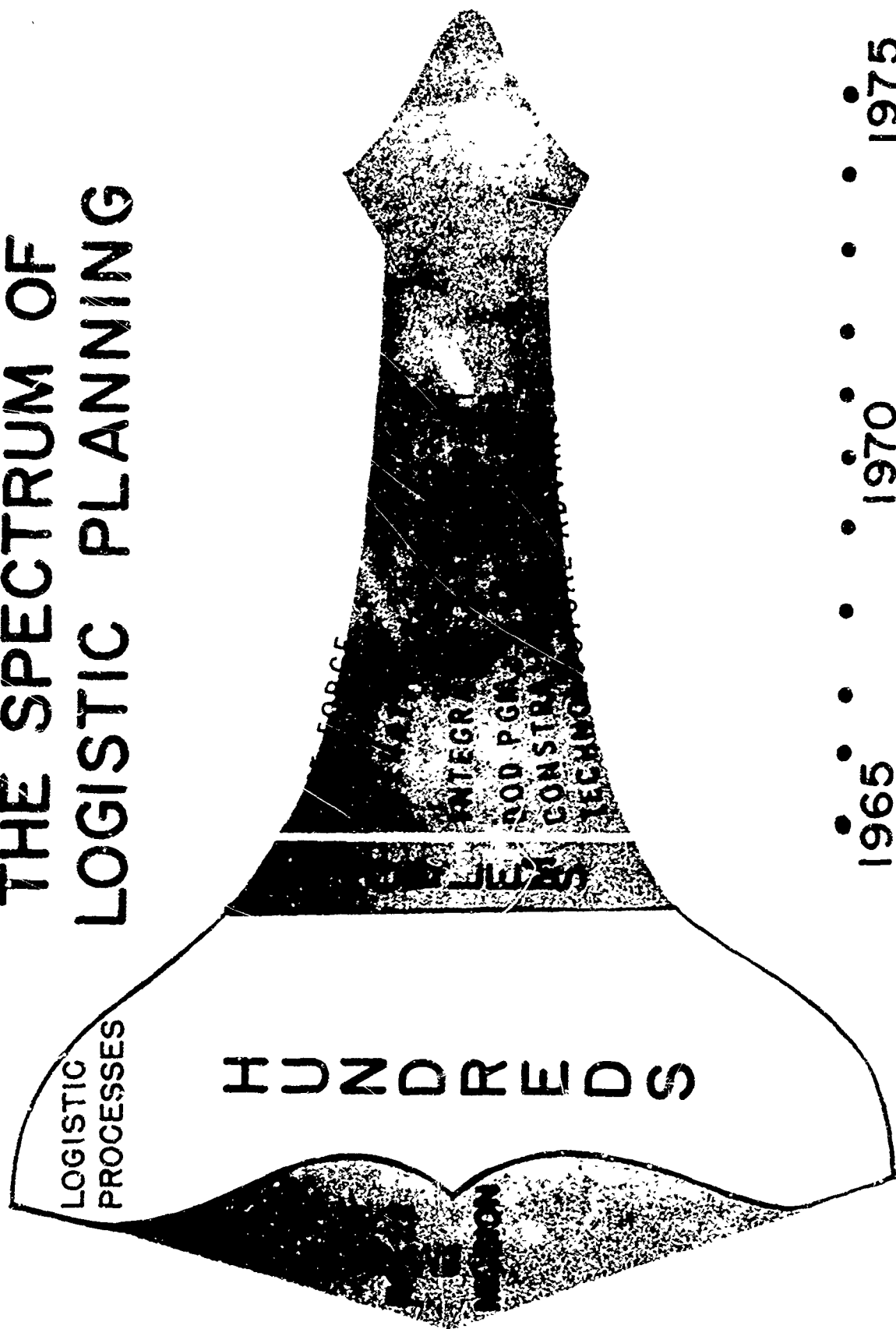


CHART 2

PLANNING PERSPECTIVE

LOGISTICS

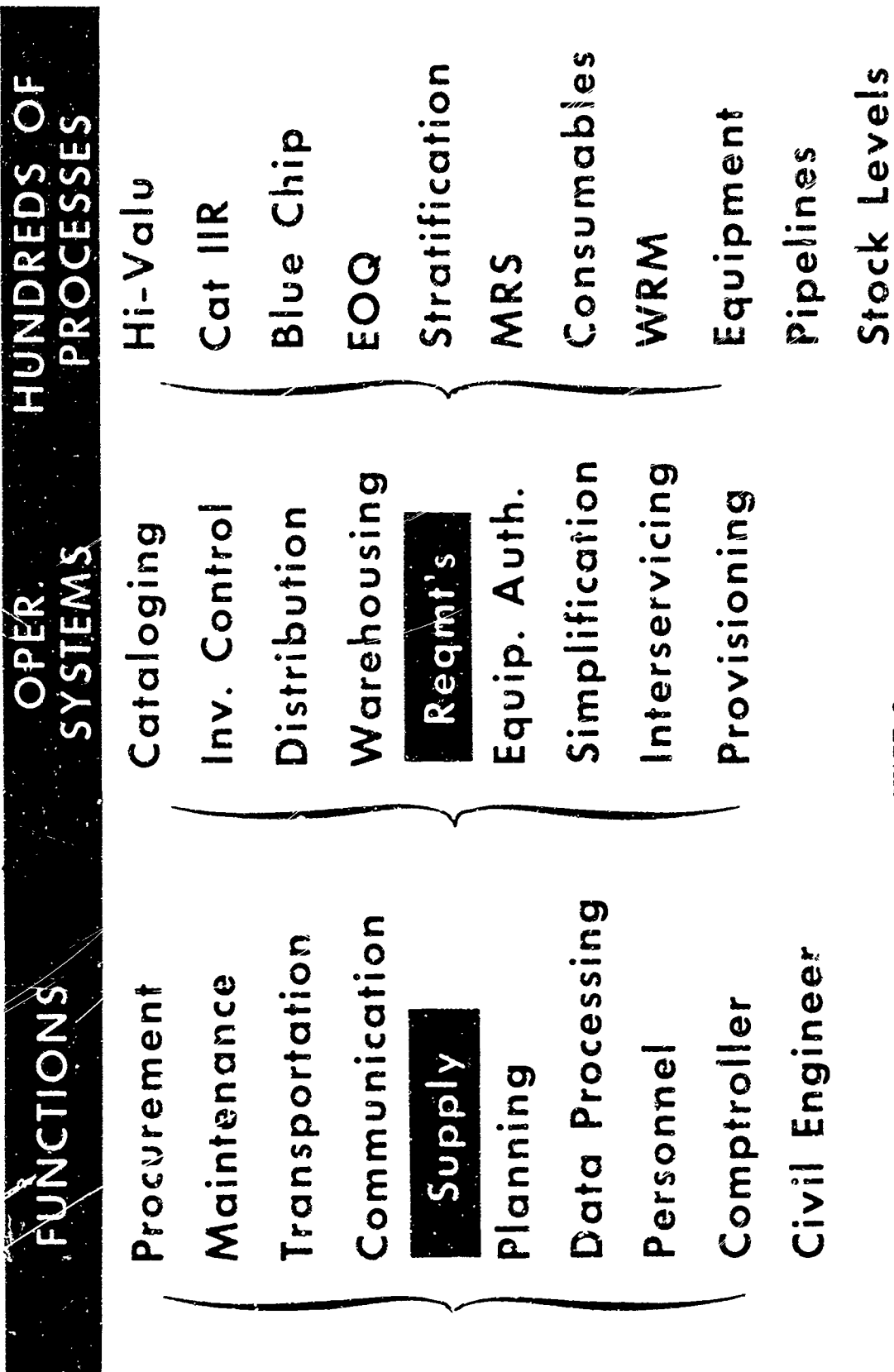


CHART 3

THE THREAT

WAR
INTENSITY

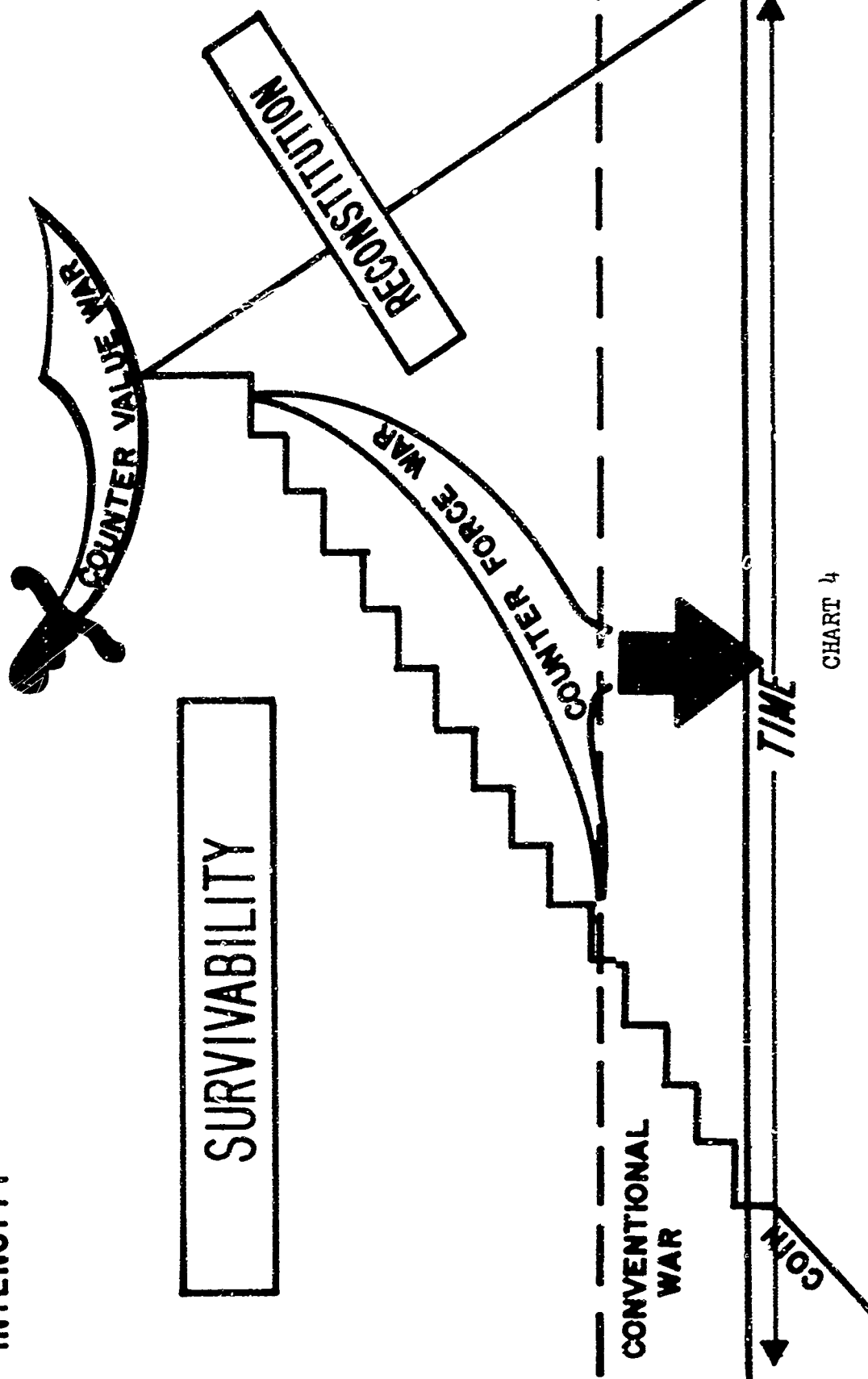


CHART 4

← The Force Structure

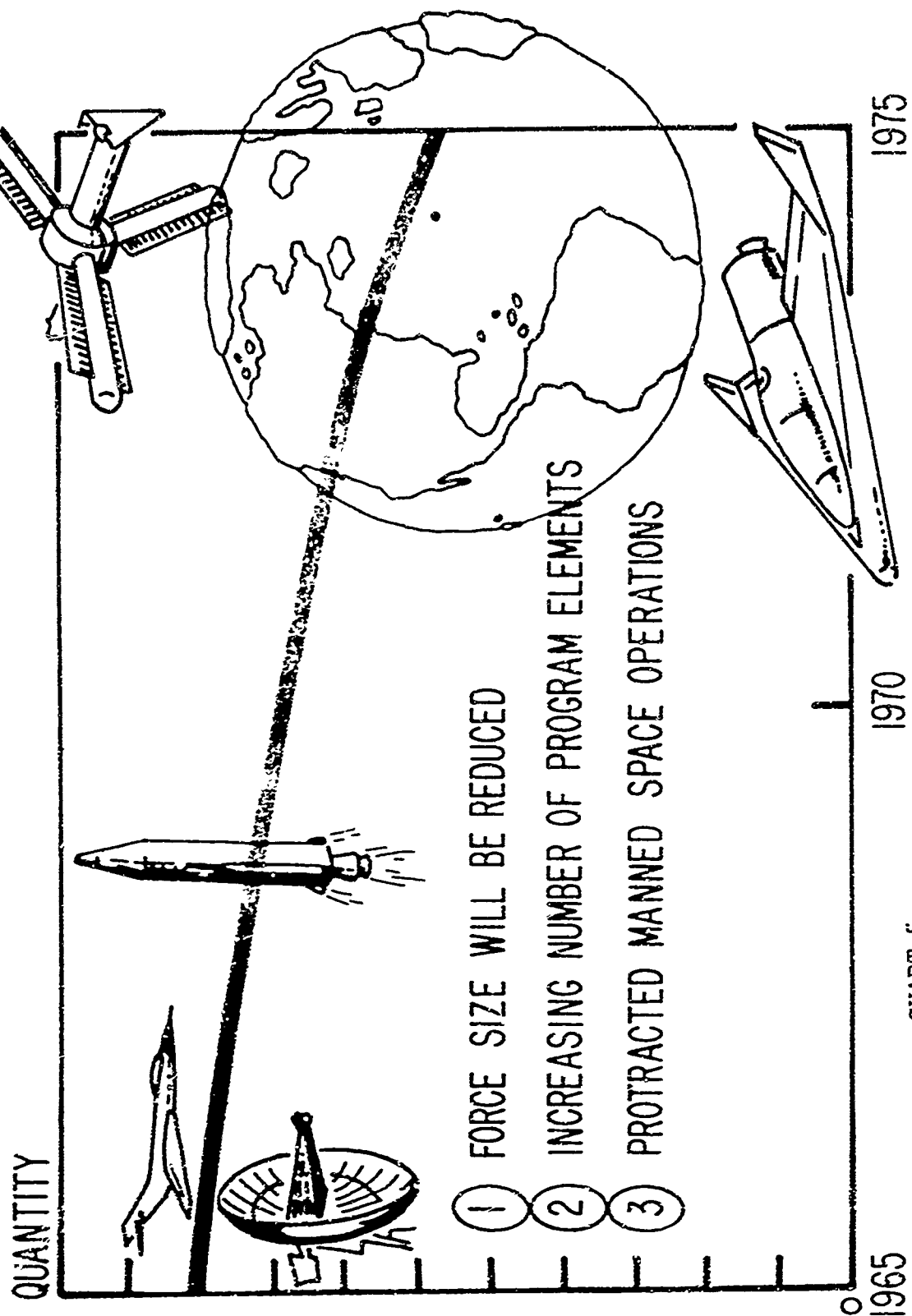


CHART 5

Technological Advances in Logistic Tools

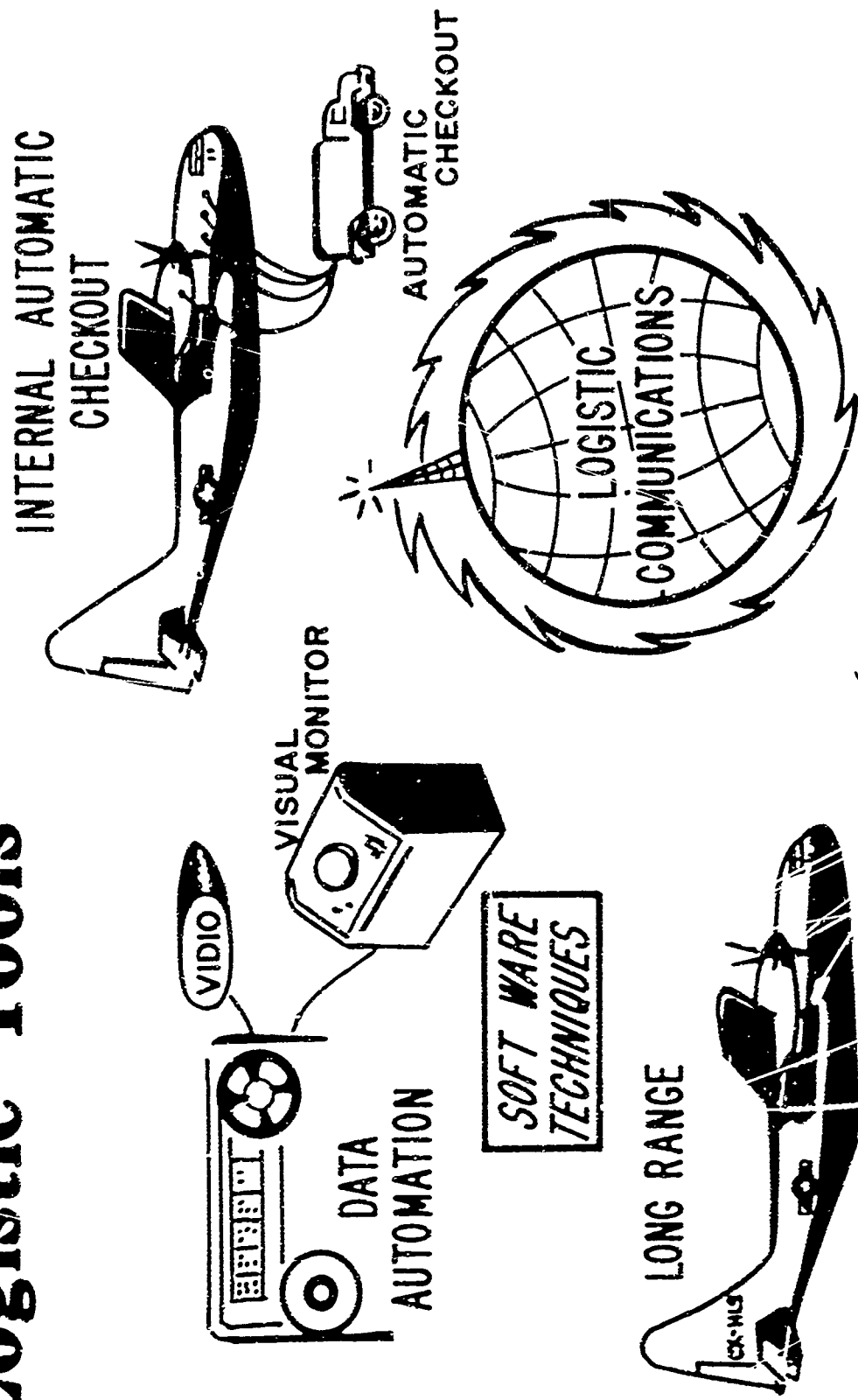


CHART 6

DOD PROGRAM PACKAGE CONCEPT

(PLAN - PROGRAM - BUDGET - FUND - ACCOUNT)

9 PROGRAM PACKAGES BY PROGRAM ELEMENT

● STRATEGIC RETALIATORY ● B-52 ● MINUTEMAN

● CONTINENTAL DEFENSE

● GENERAL PURPOSE

● AIRLIFT & SEALIFT

● RESERVE & GUARD

● RESEARCH & DEVELOP.

● GENERAL SUPPORT

● CIVIL DEFENSE

● MILITARY ASST.

● B-47 ● POLARIS

● RB-47 ● TITAN

● GAM-77 ● ATLAS

● B-58 ● REGULUS

● KC-97 ● SAC
CONTROL
SYS.

● KC-135

CHART 7

A LOGISTIC PRINCIPLE

LOGISTIC REQUIREMENTS

RESOURCES are ALWAYS LIMITED
in comparison with
TOTAL LOGISTIC REQUIREMENTS

CONSEQUENCE

CHART 8

LOGISTICS CONCEPT

FOR AUTOMATION

- ★ *Increased productivity for all resources*
- ★ *Large current commitment*
- ★ *New technology*

CHART 9

HQ USAF

POLICY EVALUATION

**AFSC/AFLC/
USER**

**INITIAL SUPPORT
PLANNING**

COMMANDS

**OPERATING CONCEPT
EVALUATION**

AFLC

**PLANNING WHOLESALE
SUPPORT**

CHART 10

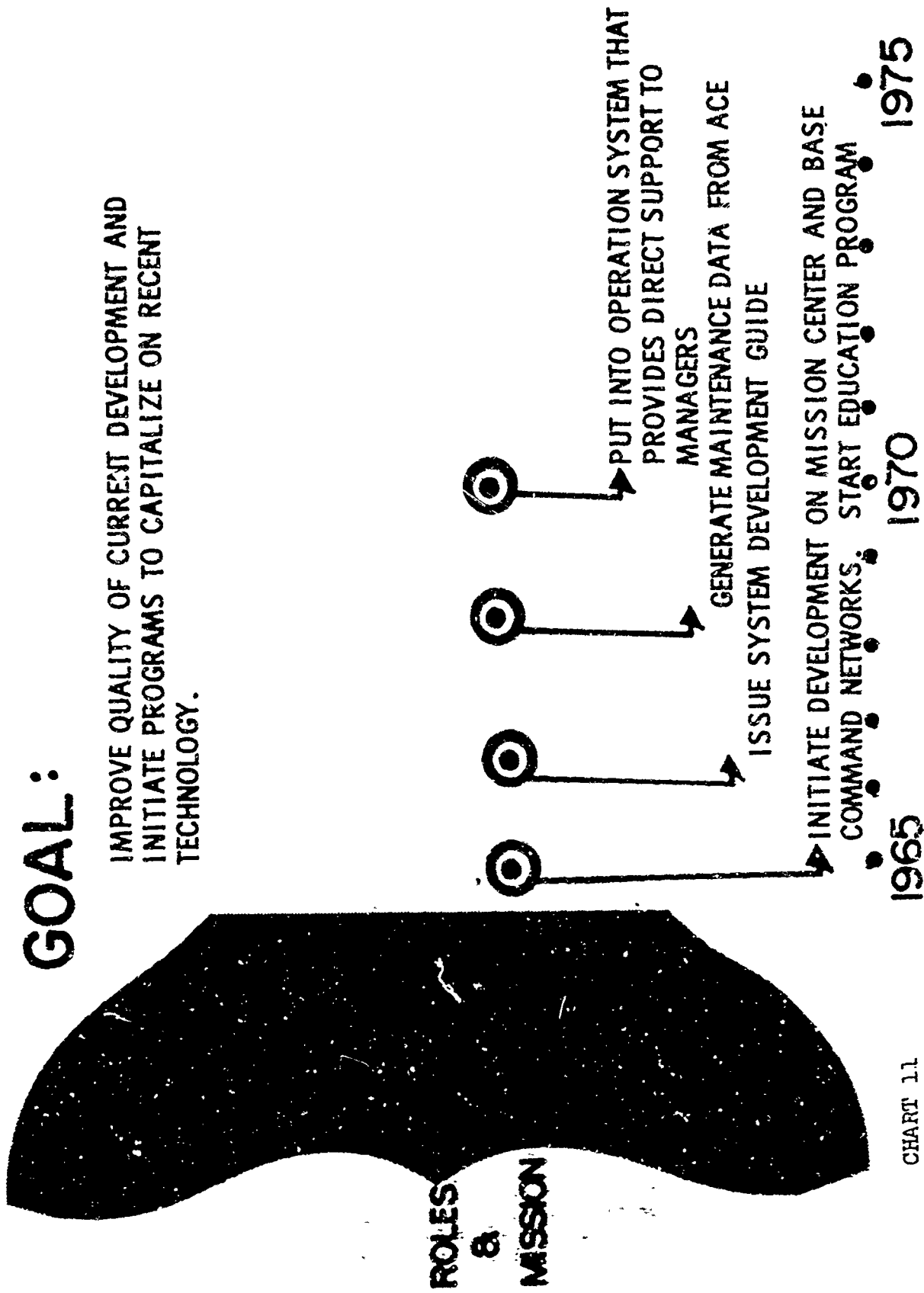


CHART 11

DOD LOGISTIC CONCEPT OF INTEGRATED LOGISTICS



OVERSHADOWS ALL PROBLEMS

AND

ALL ESTIMATES OF FUTURE

FACTORS WHICH INFLUENCE

THE DESIGN OF LOGISTIC

CONCEPTS AND PROCESSES

ROLES & MISSIONS

CHART 12

INTEGRATED LOGISTICS MANAGEMENT

AIR FORCE
MGT

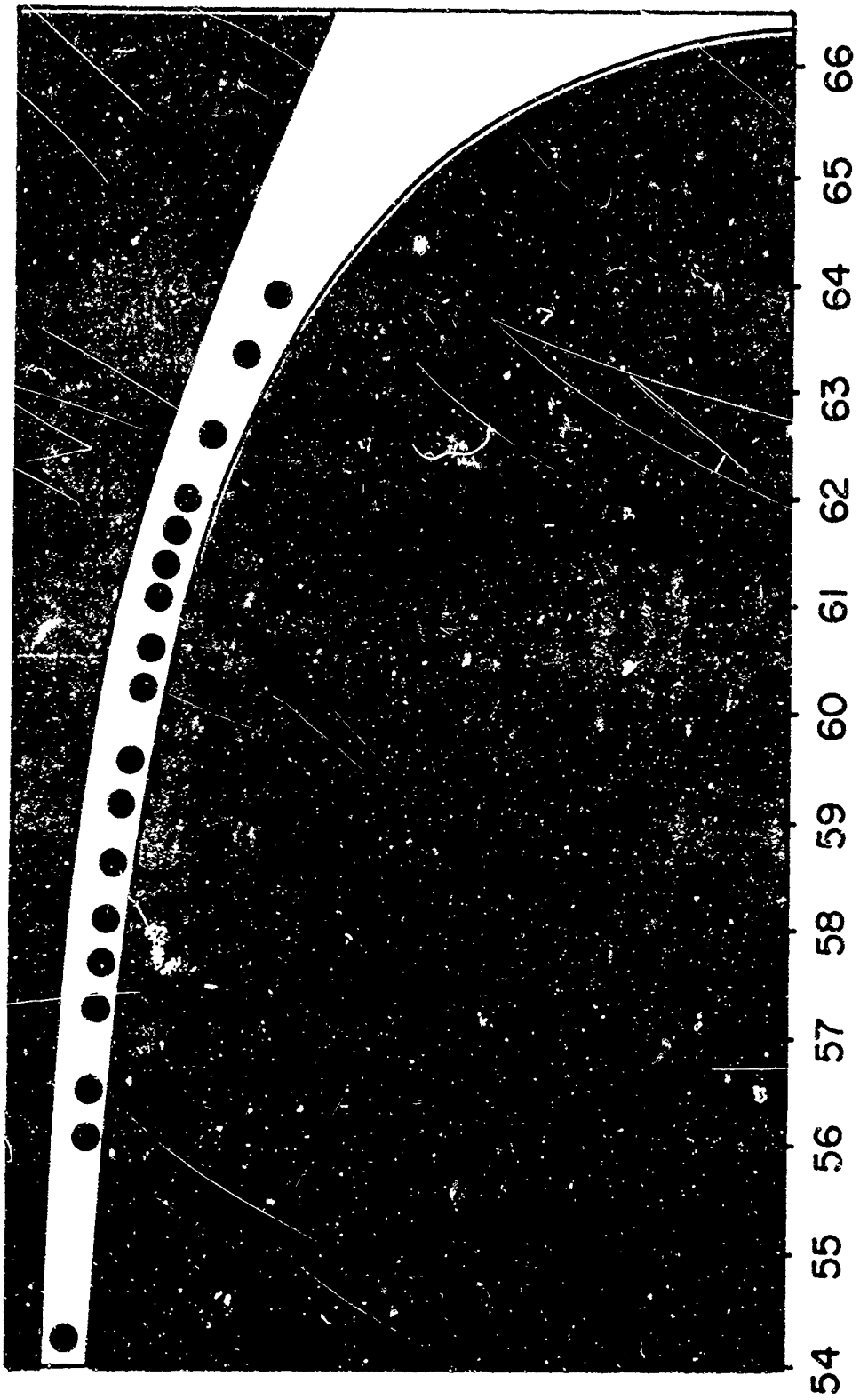


CHART 13

AN ESTIMATE OF THE SITUATION

- 1 THE SERVICES HAVE OBJECTED TO EVERY PROPOSAL TO INTEGRATE A FACET OF LOGISTICS.
- 2 THE SECRETARY OF DEFENSE HAS NOT DISAPPROVED ANY PROPOSAL AND HAS APPROVED MOST PROPOSALS TO INTEGRATE LOGISTICS. A DECISION ON SOME PROPOSALS HAS BEEN DEFERRED.
- 3 IN THE ABSENCE OF FUNDAMENTAL PRINCIPLES (DOCTRINE) THE SERVICES HAVE NO IRREFUTABLE BASIS FOR EITHER SUPPORTING OR OPPOSING A SPECIFIC PROPOSAL TO INTEGRATE SOME FACET OF THEIR LOGISTICS SYSTEMS.

CHART 14

LOGISTIC PROCESSES CLASSIFIED BY MANAGEMENT LEVEL

LOGISTIC PROGRAM RELATED MANAGEMENT PROCESSES

- MATERIEL SUPPORT PLANNING
- PROGRAMMING (Men, Money, Materiel)
- BUDGETING
- REQUIREMENTS (Men, Money, Materiel,
Information, Facilities)
PROVISIONING - PIPELINE, LEVELS, TECH. DATA
FOLLOW-ON
REPAIR SCHEDULES
EQUIPMENT AUTHORIZATION
EXCESS DECLARATIONS

• INVENTORY CONTROL

PRIORITIES
DISTRIBUTION
REDISTRIBUTION

• ENGINEERING DECISIONS

• FUND CONTROL

• CATALOGING

IDENTIFICATION
STANDARDIZATION
SIMPLIFICATION

LOGISTIC OPERATIONS MANAGEMENT PROCESSES

- PROCUREMENT
NEGOTIATION
ADMINISTRATION
QUALITY CONTROL
- WAREHOUSING
RECEIVING
STORAGE
PACKAGING
SHIPPING
- MAINTENANCE (Base & Depot)
SYSTEM
ITEM
MODIFICATION
TECHNICAL SERVICES
- ACCOUNTING
ITEMS
DOLLARS
- DATA SERVICES
- TRAINING
- COMMUNICATIONS
- TRANSPORTATION

CHART 15

INTERDEPENDENCE MILITARY CAPABILITY - LOGISTICS

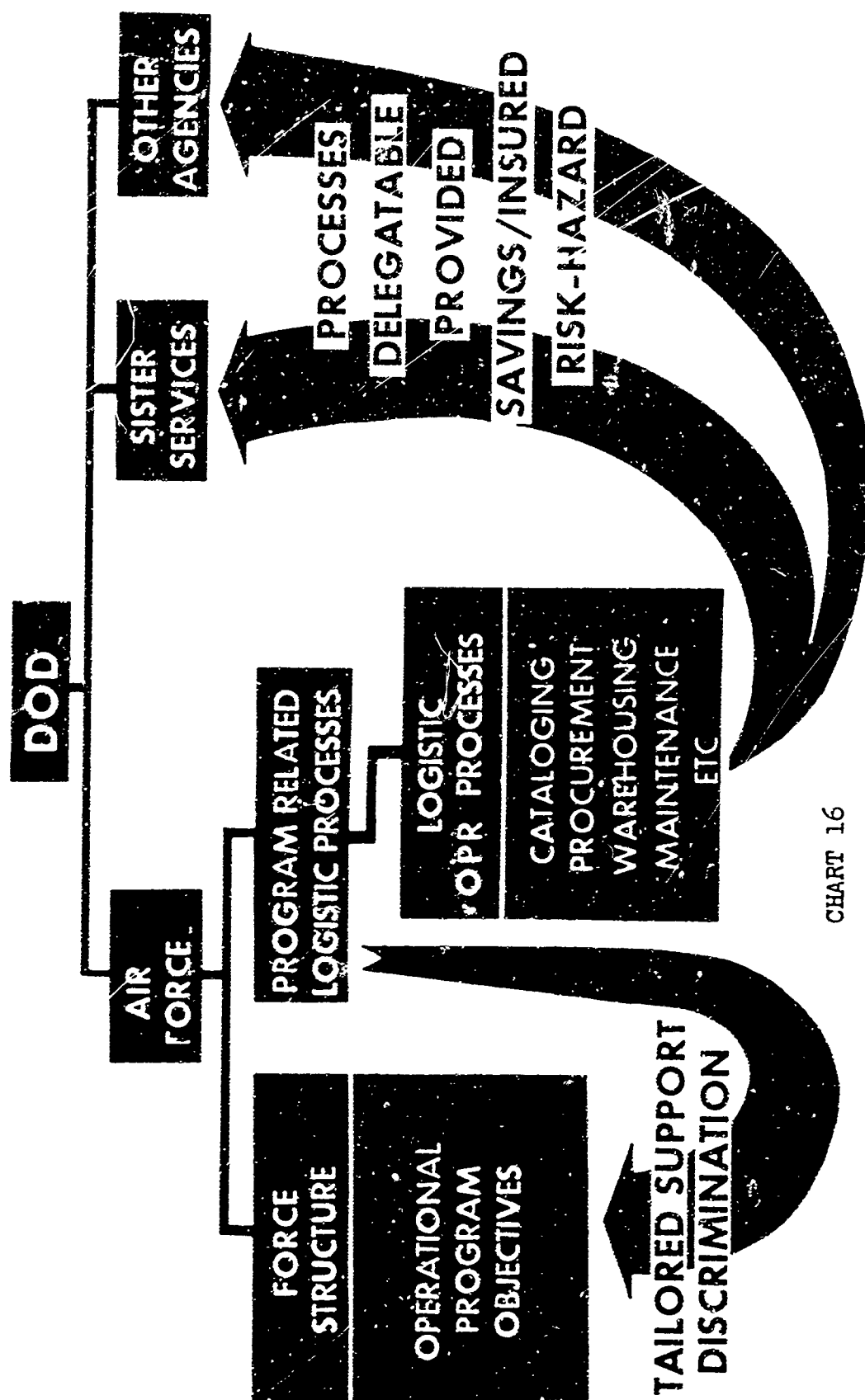


CHART 16

ELEMENTS OF LOGISTICS DOCTRINE

PROGRAM RELATED LOGISTICS PROCESSES MUST BE PERFORMED BY THE SERVICE WHICH IS RESPONSIBLE FOR THE RESULTING MILITARY CAPABILITY

LOGISTICS OPERATIONS PROCESSES MAY BE PERFORMED BY AN AGENCY EXTERNAL TO THE SERVICE RESPONSIBLE FOR THE RESULTING MILITARY CAPABILITY. SUCH SUPPORT HOWEVER, MUST BE ASSURED COMMENSURATE WITH THE DEGREE OF HAZARD THAT NON-PERFORMANCE WOULD ENTAIL

CHART 17

GOAL:

- TO ENUNCIATE AIR FORCE DOCTRINE CLEARLY ESTABLISHING THE LIMITS AND CONDITIONS TO WHICH INTEGRATED MANAGEMENT WILL BE SUBSCRIBED
- TO CAUSE THE MILITARY SERVICES TO JOINTLY ADOPT THIS DOCTRINE
- TO CAUSE THE SEC. OF DEFENSE TO SUBSCRIBE TO AND ENUNCIATE THIS DOCTRINE

PROBLEMS

NOW

ROLES
&
MISSION

1965 1970 1975

CHART 18

LOGISTICS PLANNING



SHOULD ANY CHANGE BE MADE
IN THE EMPHASIS PLACED ON
OR ARRANGEMENTS FOR ACCOM-
PLISHING LOGISTICS PLANNING
WITHIN THE AIR FORCE

CHART 19

SPECTRUM OF LOGISTICS PLANNING

EXTERNAL FACTORS:

- THE CHANGING THREAT
- THE FORCE
- OPERATIONAL CONCEPTS
- INTEGRATED MANAGEMENT
- DCD PROGRAM MGMT CONCEPT
- CONSTRAINTS
- TECHNOLOGICAL ADVANCES

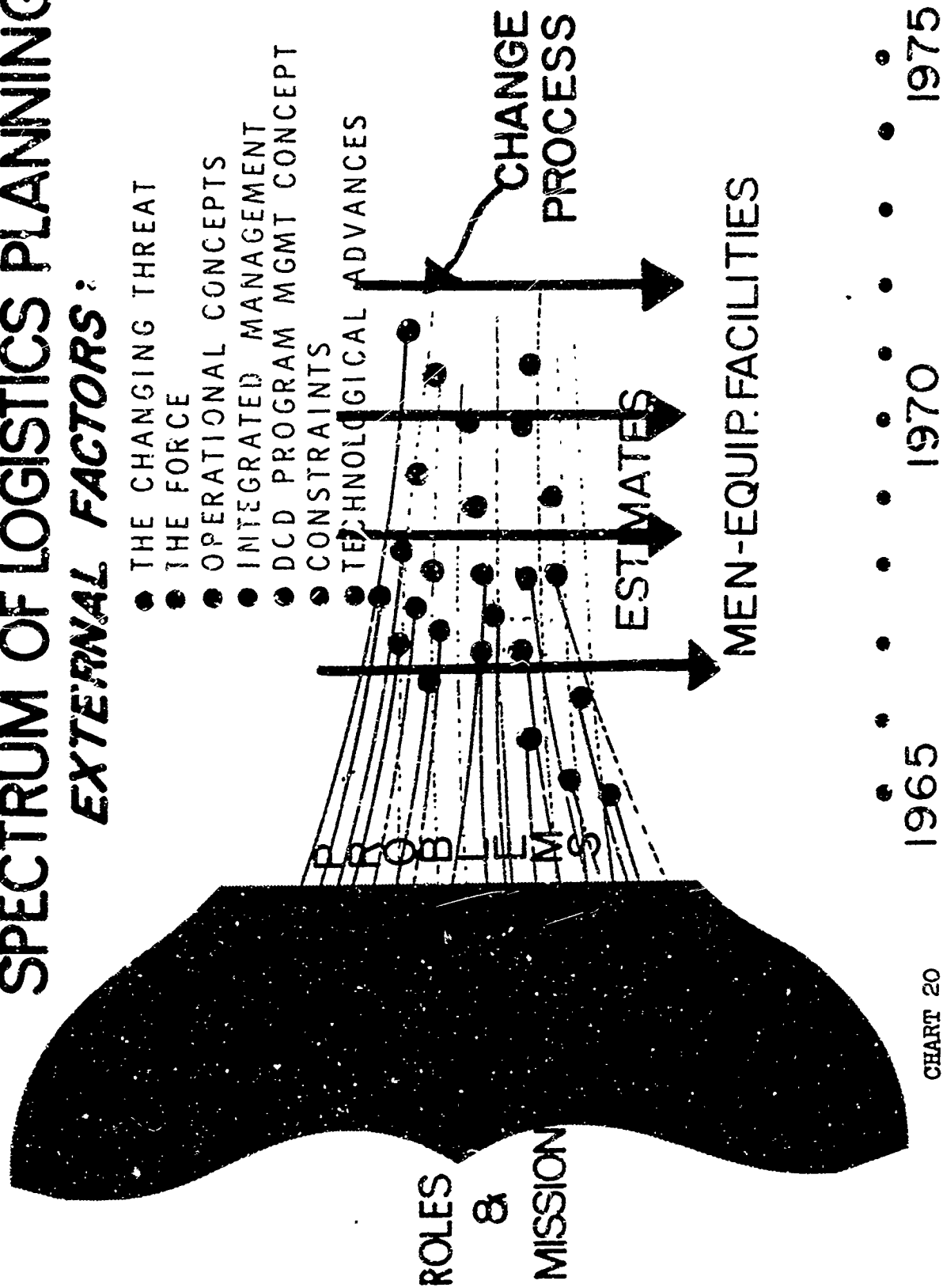


CHART 20

PLANNING OUTSIDE THE AIR FORCE...

LOGISTICS MGT. INSTITUTE, DSA ANALYSIS STAFF GENERAL
ACCOUNTING OFFICE SEC/DEF AND OTHERS ARE STUDYING
INDIVIDUAL PROCESSES OUT OF CONTEXT WITH THE TOTAL
SPECTRUM WITH WHICH LOGISTICS PLANNING MUST TREAT.

CHART 21

GOAL

A LOGISTICS SYSTEM
(DESIGN & EVALUATION) ORGANIZATION
SECOND TO NONE.

ROLES
&
MISSION

DOCTRINE POLICIES
CONCEPTS PROCEDURES
- UNIVERSITIES AND INDUSTRY
WHERE APPROPRIATE

NOW

• • • • • 1965 • • • • • 1970 • • • • • 1975

CHART 22

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SOME PROBLEMS OF LOGISTIC PLANNING FOR EMERGENCY OPERATIONS IN UNDERDEVELOPED REGIONS

W. Scott Payne

Purpose

It is the purpose of this paper to isolate and define some of the problems that arise in logistic planning for the support of forces introduced on an emergency basis into underdeveloped areas.

Scope

This paper focuses on the difficulties of planning for those activities necessary for the development and operation of a theater logistic system starting with the arrival of the initial units. It does not encompass the planning problems associated with the strategic lift nor with inter-theater logistics. While the paper thus eschews an examination of many of the elements of the logistic planning process it will nevertheless have implications for a variety of these elements as well as being more specifically concerned with logistic planning for readiness for the kind of operations discussed here.

Emergency Operations in Underdeveloped Areas

Emergency operations covers a spectrum of operations from a show of the flag to combat operations that may include rather sizable regular military forces including those of allied nations. Such a definition would cover our operations in the Lebanon crisis, the Korean War, and, more recently, in the Dominican Republic.

Underdeveloped refers to economic level. The similarities of underdeveloped countries have been summarized as follows:²

- "1. low per capita income, with attendant malnutrition, poor health, low literacy, and primitive shelter;
2. Inefficient agriculture occupying a large fraction of the labor force;
3. A dualistic - or even triplistic - economy, including a large subsistence sector;
4. A tropical, or near tropical, climate and location;
5. High birth rates, resulting in too few adults available for work;
6. An uneconomic culture, in which individual incentives to earn money are unduly limited."

In addition to these similarities -- and, in fact, partially as an outgrowth of them -- there are other striking features to be observed in emergency military operations in these countries that form a common pattern and are of particular significance to the problem at hand. These characteristic features confront logisticians with problems and elements somewhat different from those ordinarily anticipated and add to the uncertainties of logistic planning. Many of these characteristics will have been observed in recent US emergency operations in economically backward regions.

² Enke, Stephen, Economics for Development. Englewood Cliffs, N. J. Prentice-Hall Inc., 1963. Chapter 2.

Such regions are distinguished by the lack of an existing transport network. There is a paucity of railroad trackage and rolling stock, and the road system is generally rather meager with a limited number of all-weather roads of good load-bearing capability. While those countries bordering on the water may have ports of rather moderate capability, the approaches thereto and the covered storage available are limited in number and capacity. In general, there is a lack of installations that might be used for storage or service.

Most of these regions are characterized by poor health and sanitation conditions which are reflected in high disease and death rates. These conditions are accompanied by inadequate medical facilities.

In emergency operations it is important -- imperative -- that US forces arrive as quickly as possible to prevent the outbreak of hostilities or to provide combat support to government forces under attack from insurrectionists or invading units.

Typically the population of the underdeveloped countries is fragmented into several political groups -- and perhaps religious and ethnic groups also -- some of which will have the support of foreign governments unfriendly to the US. The clear distinction between friend and foe and between issues and their supporters are extremely difficult.

If combat is underway, whether sporadic or intense, the local forces likely will be incapable of providing cover or security for the US task force arrival. If the combat is severe, US logistic units may have to provide their own security at the expense of

fulfilling completely their support mission. Even if combat is not underway and no particular cover is required, it is unlikely that the local forces can provide any administrative support -- the reason for the dispatch of US troops certainly will require the full attention of the local forces.

As a matter of fact, the local forces are characterized by a lack of logistic support doctrine, system, and units. It is apparent that logistic support of some degree will have to be provided them if the operation continues for even a modest period or if it becomes intense.

In addition, it is highly likely that some support of the local population, or sectors of it, will be necessary. Typically, this will be in the form of provision of medical supplies and treatment and perhaps water and food, clearance of debris, repair of electric communication, and other utilities, administrative services of the local government, and undoubtedly other like functions.

As can be observed from recent and current operations in these regions, a high degree of para-military activity will be encountered from the onset of the operations. The guerrilla action will be directed to a considerable extent against the logistic system and in particular against ground transportation so as to isolate and eventually overrun not only military units, but also centers of population. There is no stable front or line of contact, and, in fact, the severance of the friendly front from the rear is a prime object of guerrilla activity.

As noted earlier, one of the important similarities of the backward countries is that of a tropical or semi-tropical location. This does not guarantee similarity of physical terrain of these countries which will vary from mountainous tropical jungles through lowlands, river valleys, and deltas to desert. What is similar about the terrain in these areas, however, is that they generally are unfavorable to the kinds of military operations toward which much US training is focused -- that ordinarily conducted in Western Europe.

In summary, emergency operations in underdeveloped countries can expect to encounter a sparse network of roads and rails, meager logistic installations, difficult terrain, a poor resource base, and low sanitation levels. Political difficulties -- that required US forces in the first instance -- will generate attitudes of uncertainty to those of outright hate on the part of the populace as well as providing an atmosphere of confusion, irrationality, and one conducive to incitement of riot, further insurrection, and revolutionary support. Guerrilla action can be expected to start if it has not been underway for a good long time.

The implication of the foregoing comments for logistic support and, at a different level, logistic planning is apparent. In the context of the purpose of this paper there are three problem areas of particular significance; 1) the development and operation of a logistic base -- and system -- in a very difficult environment, 2) the protection of the logistic system, particularly the lines of communication (LOC) and the logistic base complex -- be it one or many small service and administrative areas, depots and the like --

against intermittent or continued guerrilla attack, and 3) partially to complete logistic support of the local forces (and perhaps allied forces in combined operations) and some sectors of the population.

This paper directs its attention to a few, not all, of the difficulties attendant upon logistic planning in these problem areas. Moreover, no standard planning factors or elements will be suggested, but the sensitivity of current standards to these kinds of operations will be noted, and the directions that reevaluation ought to follow can be observed.

Development and Operation of a Logistic Base and System

An increase in requirements and changes in policy will be necessary in three traditional logistic functions. Moreover, in the environment under discussion the interconnection of these functions is such that an increase in the need of one serves as a multiplier for the need of one or both of the others. These functions are transport, engineer construction, and hospitalization and evacuation.

Railroads will be used very little, partly because of the limited trackage and equipment and partly because of their vulnerability to guerrilla action. Thus, other modes of transport will have to meet the need, or the tonnage will have to be reduced. As the transport net in total is generally inadequate, this means that the materiel probably will move over a limited road net.

The overall physical condition of the road net being fair to poor for the most part raises another transport problem common to these areas. The number and size of bridges, the rather low load-bearing condition and limited width of roads may well set a restriction

on the weight and size of the vehicles that are to move over this network. In some areas, particularly Southeast Asia, the preponderance of the terrain will be so swampy as to preclude the use of the large and efficient trucks, which might well be useful in other areas, like the Middle East. Consequently, while the underdeveloped regions are characterized by poor roads generally, the kinds of equipment best suited for one area may not be suited easily to another. These problems become aggravated, of course, as the force size and duration of operation increase.

The transport problem might be met by more cross-country movement, a greater mix of transport vehicles, air transport, road building and rehabilitation, or a combination of the two. It might be met also to a degree through prior economic and military assistance. However met, the point is that the logistic planner must take account of these restraints -- despite the uncertainties in assessing their magnitude -- on transport in planning for contingency operations in the areas of interest here. And he must encourage and participate in analytical studies that will show him the trade-offs among the alternate means of overcoming the restraints, uncertain as they are.

The poor transport network, its lack of fixed installations, the poor sanitation conditions, the nature of the physical environment -- including frequently a paucity of construction materials -- will place a requirement above normal on the engineer units in such forces. At the outset they will be needed to improve and rehabilitate the road net, to clear obstacles, and provide clearance, distribution, and storage areas. To offset the lack of railroads -- a mass tonnage

cover -- tracks might be the only alternative mode at the outset. This means these units will have to increase their capability -- more units or more frequent movement; and the latter requires hard surfaced broad roads for such sustained effort. Here again the engineer requirements will have to increase commensurately. These increases are, of course, subject to considerable variance, and generally they are a function of the size of the force, the duration of the operation, and, as we shall see later, to other important factors characteristic of these sorts of emergency operations. In summary, as with the transport function, the planning factors for the engineer activities must be reevaluated and likely must be increased -- but the trade-off's must be examined and the range of uncertainties accounted for.

Disease will present a particular problem in limited war in underdeveloped areas. This can be inferred first from experience in World War II: The Pacific, Southeast Asia and the Middle East theaters had higher disease rates among US troops than did the European theater. Moreover, the incidence of disease is related to environmental conditions and the prevalence of disease in the area of operations. Thus, variables affecting significantly the rate of disease among troops are (1) general level of sanitation, (2) general health of the population, and (3) the prevalence of endemic diseases. In underdeveloped regions (1) and (2) are poor, and (3) is rather serious. Disease rates can be expected to be high relative to other areas. This comment is reinforced by recent operational experience including that of other Western forces.

It is worth reminding ourselves that disease is the big casualty producing factor in military operations in terms of the percentage of admissions to hospitals. (79% of all admissions to US medical treatment facilities, all overseas theaters, January 1942 - August 1945, was for disease, 13% for injuries, and 8% for combat wounds).

Data indicate a surge in the disease rate in the first two or three months of operations in any area. We can expect this surge to be more pronounced in underdeveloped regions because of the impact resulting from the initial introductions into these regions of poor sanitation and health, and because of the extremes in temperatures and weather characteristic of these areas. This surge can be expected to occur in the very early and critical stages of deployment immediately following entry into the area.

It is apparent from the foregoing that in underdeveloped regions non-battle casualty loads will be high, they will peak during deployment, and likely will peak again during extremes in seasonal variations. The peaking will have an impact on hospital bed requirements and will cause serious degradations of the support (and combat) capability intermittently during operations. The general increase in the casualty load may require some force structure changes to accommodate additional preventive medicine units as well as a reorientation in hospital bed and evacuation requirements.

A somewhat different but nonetheless related problem that will be encountered in underdeveloped regions is that of acclimatization. Regardless of the disease rate consider the importance of the initial effect on US troops entering a region of poor health and sanitation and high disease incidence where combat and support activities will have to take place part of the time under intense heat, or monsoons, or wind and cold. One must remember also that quite likely there will be no opportunity for acclimatization before arrival in the region and likely there will be a lag in the effectiveness of preventive medicine measures. It is clear then that in operations in underdeveloped regions a rather serious degradation of support capability is to be anticipated upon entry into the region.

The importance of the preceding discussion to logistic planning like that of the engineer and transport functions is apparent.

Protection of the Logistic System Against Guerrilla Action

One needs only to look at South Vietnam today, Malaya, Indo-China, and Algeria recently, to grasp the difficulty and the critical nature of maintaining security of the logistic system in underdeveloped regions.

Typically, the guerrilla action will place considerable emphasis on the LOC and logistic complex. The results of such action are three-fold. First, the flow of military supplies to the combat units and other goods to civilians is severely interrupted, second, a number of combat troops are diverted to protect the logistic functions, weakening the combat units in their other missions, and third, various military units and villages are isolated to be overrun or converted later.

Experience shows that maintaining the LOC in the face of concerted guerrilla action is costly in manpower and equipment. The constant interruption of ground transport routes by demolition as well as direct attack on the movement of goods, raised the engineer construction requirement significantly. This requirement was further increased by the need to provide some sort of passive protection for various depots and other supply and service areas.

The guerrilla attacks on the ground transport modes and against logistic facilities has resulted in the diversion of as many as one-third of the combat troops to protect such installations. In isolated instances the number of combat forces committed to the protection of road segments appear startling in view of the total number of troops and the length of the road segments involved. For example, in two separate cases, between 60 and 70 combat troops per mile were required to maintain rather short segments of road -- for daylight operation only.

Perhaps the most critical -- and perhaps least appreciated -- consequence of the guerrilla action is to be found in the decision to abandon ground routes because of the high cost of maintaining them. In many instances the abandoned road segments were replaced by air transport. In some instances this mode proved incapable of meeting the requirements, but in others it did. However, and this is very important, in abandoning sizable ground routes, it was found that the local population in that area was also abandoned, or, equally important, felt abandoned, to become supporters of the guerrilla movement. In addition, friendly troop units at the end of these

segments, supplied and reinforced by air alone, were more vulnerable and less capable of engaging in aggressive action. The sense of isolation apparently was also a detriment to morale.

In summary, the costs of maintaining a logistic system in the face of guerrilla action can become high, and in logistic planning extreme care must be taken to look at the alternative means of meeting the requirements so that a logistic need is not met at the expense of other missions.

Support of Local Forces

Typically the local forces in underdeveloped regions are maintained at levels that exceed the capabilities of the economies to maintain them; and typically the logistic structure of these forces while adequate for garrison duty and perhaps internal security, would likely break down under moderate to severe combat conditions.

The implications of the above are that in combat the logistics structure will have to be augmented, and some items of supply will have to come from external forces. The former likely will require technical manpower and perhaps logistic units from US forces; the latter will require an increase in US resupply rates - particularly for ammunition. The problem may be magnified if, in the initial combat, the local forces suffer heavy equipment losses, for to be maintained as operational fighting units they will have to be re-equipped as well as resupplied.

Characteristically, much of the military equipment in these countries is obsolete, and repair parts for it are not available. Generally, these countries do not have maintenance fleets nor war

()] reserve stocks to any extent. This implies incompatibility between the equipment of local forces and that of the US forces supporting them. And it implies also that the variations in weapon mix -- and probably in troop composition -- among underdeveloped countries and hence in supply-rates will differ from those of the US and among each other.

Thus, the logistic planner must be prepared, among other tasks, to estimate (1) an increase in spare part supply - if available - for varying kinds and ages of equipment, (2) a resupply rate of other items for varying force mixes, (3) requirements for varying kinds of major equipment, (4) the resultant increase in US technical service units needed to (a) instruct and serve the local forces, and (b) meet the increased maintenance arising from the use of outworn local equipment and from the increased wear on US equipment traveling cross country and on unimproved roads.

()] Hopefully some of the increased requirements for logistic support by US forces to aid the local units might be offset by the use of local labor for various functions such as unloading, sorting, and other like functions. It is true manpower is one commodity that most of the underdeveloped countries have. These countries typically suffer from unemployment and underemployment. However, other factors are prevalent that may inhibit the availability and use of this labor. Most of the labor force, though agricultural in nature, is concentrated near the cities. Thus, landings or deployments at distances from the cities will have a smaller labor market to draw upon. The poor health of the population results in high absentee rates. The

skills of the labor force generally are few, and the uses to which this can be put are few. The labor force is not highly mobile; the workers cannot be counted upon to move any distance away from their locale to aid in the transport and other functions as the logistic complex moves out from its initial landing site. And most important, is the politico-military situation. The degree of devastation, the stability of the government, and the general attitude of the population toward the entrance of US forces, and its fear of reprisals from the guerrillas will all have a severe impact and restraining influence on the availability of local labor.

Thus, again the logistic planner is beset with uncertainties in trying to determine some guide lines for the use of local labor in such operations.

Critical Period in Introduction of Forces

One additional comment of importance needs to be made. The significant and critical time in emergency operations in underdeveloped regions is in the early phases of the operation. Briefly this is due to the following reasons:

1. Political uncertainty and fragmentation of the local population
2. Supply and support of local forces and population
3. Endemic diseases
4. Inadequate infrastructure
5. Lack of acclimatization of troops

The disorder and uncertainties prevalent at the outset of such operations may be seen clearly in the following excerpt

from an interview with Under Secretary of State Thomas C.

Mann on the Dominican Republic crisis, reported in the New York Times, Sunday, May 9, 1965, Page E-3:

"Our intelligence from the very beginning was that the revolutionary movement itself was probably led by elements in the Dominican Revolutionary (pro-Bosch) part, but it was clear very early that elements of the three Communist parties in the Dominican Republic succeeded in organizing, arming, and moving into the streets very sizable military forces. This was known from the beginning.

...

"What was not known, and what caused the embassy ultimately to decide that the lives of American citizens required evacuation, was the virtual collapse in the ability of the regular forces who were opposing the rebels and consisted chiefly of military, army, navy, and air force, to bring the situation under control to the point where lives could be protected.

"The movement from a posture of a normal revolution to a situation of almost complete chaos was very sudden and occurred only late on the afternoon of April the 28th." [4 days after the revolt started.]

SUMMARY

The foregoing discussion has been directed at isolating just a few of the critical problems that confront the logistician in planning for emergency operations in underdeveloped regions.

Clearly there needs to be continuous re-evaluation of planning factors to reflect political events and the military capabilities and environmental constraints anticipated in the spectrum of underdeveloped regions into which our forces might be called. This re-evaluation should focus on transport, engineer, and medical requirements at the outset. The re-evaluation should examine thoroughly

the trade-offs involved in looking at alternate means of providing logistic support. And lastly, the thought must be kept in mind that the first few days of such an operation are critical.

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PLANNING FOR BALANCED READINESS

- Introduction -

The concentrated effort of the Department of Defense over the past few years to balance military resource requirements against total national requirements and to achieve, within projected military requirements, an efficient allocation of resources has evoked significant responses from the Military Services.¹ Specifically, all of the Services have undergone major reorganizations and intensified their efforts to use the most effective management techniques available. Although considerable attention has been focused on the major outlines of these reorganizations, and to the dynamics of the decision-making process for major weapon systems, of equal significance is the degree of coherence and effectiveness achieved by each of the major organizational components which are a part of the Defense structure. If the larger effort of the Department of Defense can be characterized as "planning for balanced readiness," a detailed examination of how one of these major organizational components participates will serve to illuminate the essential elements of planning.

In this case, the examination will be from the point of view of wholesale materiel management. In the Army reorganization of 1962, the materiel management job was sorted out from other Army missions and functions and assigned to the U. S. Army Materiel Command (USAMC).² It is proposed to examine the issues involved in planning for balanced readiness from the point of view of one of the subordinate Commodity Commands of the USAMC, the U. S. Army Electronics Command (USAECOM) which is responsible for the management of Army communications-electronics materiel.

1

"Study Report on the Programming System for the Office of the Secretary of Defense." OASD (C) Programming, Directorate for Systems Planning, 25 June 1962; Hitch, Chas. J., "A Planning-Programming-Budgeting System," Proceedings of the National Advanced-Technology Management Conference, Sept. 1962, in Kast, F. E., and Rosenzweig, J. E., Science, Technology and Management, McGraw-Hill, 1963.

2.

"Report on the Reorganization of the Department of the Army," Department of the Army, December 1961.

To provide an index of the scope of the materiel management job assigned to USAECOM, of the 230 equipment systems identified as most important by the Army in its "Army Force Development Plan (AFDP)," the USAECOM is responsible for the design, fielding, and control of 80 equipment systems and has a supporting interest in about 130 of the remaining 150 equipment systems. Its annual budget is almost a billion dollars, compared to an approximate six billion USAMC budget; the USAECOM is directly responsible for about 4,800 major items and about 120,000 secondary items and repair parts. It is responsible for research, development, production, fielding, and support-in-inventory of its major items; it has appropriate operating elements to perform these functions. It also has a small autonomous organization for performing logistics research; the USAECOM Logistics Research Agency (LRA), which was established in 1954 to perform logistics studies for Army electronic-communications equipment.

In conducting its logistics research studies the LRA noted that certain recurrent problems assumed a general pattern and can be said to hinge on the broader issue of total planning for balanced readiness. Following the usual approach to logistics research, as part of the LRA logistics study program, individual problems were isolated, investigated, and "sub-optimized" to the extent possible. However, it was often the case that the particular difficulty under examination was merely the symptom of a general absence of comprehensive planning; a lack of operational coherence or effective communication, or some other basic structural defect. The provocative happenings in the Department of Defense, and specifically the Army reorganization of 1962, gave LRA reason for trying its hand at developing an integrated design for the management of Army electronic materiel and solving some of the basic problems inherent in military logistics management. Listed below are some of the basic problems, some of the essential elements of logistics planning, that our previous work exposed.

First, opposing the achievement of a posture of balanced readiness is the constant intrusion of secondary functional objectives throughout the materiel acquisition cycle: Technological, program, budgetary, legal, and political, to name a few. There is the case of the development engineer whose primary obsession is the designing

of the highest possible level of performance into Army hardware without due regard to the relative level of performance which is satisfactory or to the scheduled operational date for the equipment or its related items. In some extreme cases an Army requirement is forced to conform to the skill or bias of the developing Agency. Then there is the case of the program manager under the extreme pressures of program or budgetary constraints. In general, the program manager deals with abstract terms equated with dollars; too often success is measured by obligation of an allotted program within given fiscal schedules, without proper regard to what is being procured and the required operational schedule. Then there is the case of legal and regulatory constraints; the Armed Services Procurement Regulation and the intricacies of contract award and administration, Small Business, Labor Set-Asides and all the rest. In this vein, any interface with the American corporate structure, coupled with the expenditure of public funds, involves the possibility of Congressional review or political repercussions. Clearly, these secondary constraints and objectives can be brought into proper perspective only by the maintenance of a realistic, integrated plan, keyed to operational and materiel readiness objectives.

Another basic problem in achieving effective planning is the attainment of organizational coherence. Within military logistics organizations there is a tendency to gravitate to isolated functional compartments. This comes about through the common practice of specialization for maximum utilization of personnel resources, and the fact that a traditional taxonomy of related operations exists: research and development, supply and maintenance, procurement and production, etc. The functional alignment of Department of Defense, Department of the Army, and U. S. Army Materiel Command predetermines the substance of much guidance, policy, and reporting requirements and tends to establish isolated functional "stovepipes." At the operating level, this functional parochialism must be balanced against sequential equipment life-cycle considerations geared to operational requirements. Although the need for specialization is undeniable, the mechanics and the tools employed in functional management may tend to become self-serving and contribute to a tradition of technique. "Management" is often measured in the relatively abstract terms of this technique, leading to a nominal expression of reality and a measurement of accomplishment in terms of skill in exercising the technique.

A third important consideration is effective communications. A major factor in the degree of success attained in planning for balanced readiness is the availability of timely and factual management information. Within a dynamic environment, with responsibility for many items of materiel, and with a large operating and management organization, the gathering, summarization and dissemination of management data represents a task of major proportions. The control of operations, the adjustment of plans, throughout the extended life-cycle of military materiel, requires the development and maintenance of sophisticated, automatic management information systems. The adverse conditions which result from a lack of integrated and timely information are many and are not considered to require illustration in this paper.

Finally, the crux of the military materiel management process is the establishment of realistic and balanced plans which are continuously consistent with higher level priorities and objectives and at the same time incorporate the dynamics of evolving operational factors. Hardware requirements must be continuously aligned with shifting tactical concepts and technology; performance must be continuously checked against this dynamic planning and the necessary trade-offs against time, cost, and technical performance determined.

- Logistics Research Application -

Throughout 1963 the LRA performed a series of dependency network analyses of the basic work processes implicit in the USAECOM mission assignment.³ As a result of this work certain basic concepts of command and staff relationships and organizational requirements were developed. Particularly, the need for the establishment of an effective "Commodity Management" staff, to impose the discipline of item system control and direction, matrix-fashion against the traditional functional control and direction, was recognized and defined in detail.⁴ These studies formed the conceptual basis for the

³ LRA Study 63-179, "PERT Analysis of the Development and Execution of the USAECOM PEMA Program," 7 Feb 1963.

⁴ LRA Study 63-176, "Optimum Design for Command, Control, and Operational Workflow in USAECOM," Oct 1963.

restructuring of the USAECOM⁵ that was approved by the Commanding General of the USAMC, in March 1964.⁶ One of the basic achievements of the USAECOM restructuring was to improve the balance between logistics planning, programming, and operational direction and to establish integrated management of electronic commodities throughout their life cycle. In the process, a strong concept of planning for balanced readiness was established that properly subordinated secondary functional goals and objectives to major Army Programs and priorities; the organizational structure was integrated to permit a better balance between item-system control and direction, and functional control and direction; and an integrated, automated information system was established that correlated external and internal long-mid-and-short-range plans with operational developments.

- Planning Interface -

A prerequisite to effective planning and management at the Army Commodity Command level is the establishment of a means of "coupling" commodity planning with some expression of the comprehensive needs of the Army extending well into the future, which provides, with some precision, dates, costs and schedules. The Army Modernization Program, expressed in the Army Force Development Plan (AFDP), fulfills this need and was selected as the basic input to overall planning. The USAECOM research and development program is correlated to the AFDP thereby establishing a powerful link between basic Army 20 year plans, the total Army programming and budgeting process, and the technological competence of the USAECOM. Complete correlation has been established between USAECOM effort and military missions. Arrayed against the AFDP major item and its related planning objectives as set forth in the Combat Development Objectives Guide (CDOG), and the Army Research and Development Long Range Plan (ARDLRP), are all USAECOM R&D items that are a part of the major item; that may be in operational interface with the major item; that are a supporting effort. For each item or system, in each generation of equipment, there is

⁵ LRA Proposal for USAECOM Reorganization, 12 Dec 1963; approved by Commanding General, USAECOM, 17 Dec 1963.

⁶ Memo, Lt. General F. S. Besson, Jr., Commanding General, AMC to Chief of Staff, USA, 26 Mar 64, Subject: Restructuring of the U. S. Army Electronics Command.

established a planned life cycle - the decision date, with regard to engineering development, the phase-in period, the full inventory period, and the phase-out period.⁷ The resulting document, the "USAECOM Long Range Program Plan," is then used as a base reference to the USAECOM R&D Plan, (an accounting of all research and development tasks and sub-tasks against appropriate Qualitative Materiel Development Objective and Qualitative Materiel Requirement references), and the detailed planning performed by the Commodity Management staff.⁸

- Planning and Control -

In the USAECOM, Commodity Management Offices for specific groupings of materiel have been established on the Headquarters staff. These Commodity Management Offices serve as a middle ground between the Long Range Program Plan and the detailed planning and work scheduling performed in the operating Directorates. The summary life cycle schedules in the Long Range Program Plan are "exploded" into detailed PERT network analysis of item-system schedules which in turn are supported by "work package" schedules reflecting the planned effort at the bench level. The initiative for this detailed planning effort is taken by the Commodity Manager who coordinates with the operating directorates (Laboratories, Procurement and Production, Materiel Readiness) and drafts a Commodity Manager Master Plan, CM₂P. This is essentially an abbreviated version of the Project Manager Master Plan (PM₂P) developed by USAMC for use by Project Managers; Figure 1 summarizes the content of the CM₂P.⁹

This detailed life cycle plan forms the primary input to a USAECOM-wide PERT-based management information system,

⁷ Lee, Norman; Rugsis, A. And Kimble, R.; "Some Experiences in Matching Electronics R&D Against an AFDP Model of the Army, 1964-83," presented at the 4th Army Operations Research Symposium, 31 March 1965.

⁸ ECOM Regulation 70-1, USAECOM Research Development Plan, 30 July 1964.

⁹ LRA Study 64-203; ECOM Pamphlet 11-1, Commodity Management Guide, Vol. I and II, Sept. 1964.

developed by previous logistics research.¹⁰ This PERT-based system, the USAECOM Life-Cycle Management System (LCMS), establishes and inter-relates dependency networks for each major item which is part of an electronics equipment system. As Figure 2 indicates, it correlates the work package schedules from the operating directorates with a system-item schedule keyed to the projected operational readiness date. This basic LCMS automated procedure has the capability of "shredding-out" summary management reports in various functional areas, including, as indicated in Figure 3, a correlation between various funding programs. By this technique the various fund categories can be periodically summed to account for adjustments to the equipment schedules and changes in long range plans, as well as the interaction between programs.

The information systems just described are, in effect, the nervous system of the USAECOM and are useful only if they operate within a coherent organization. As displayed in Figures 4 and 5, the present USAECOM organization represents a careful balance between the three basic dimensions of materiel management: Control and direction of RESOURCES; control and direction of OPERATIONS; and control and direction of SYSTEMS-ITEMS. Figure 5 identifies the six basic USAECOM Commodity Management Offices by their specific commodity grouping.

Figure 6 provides an overview of the USAECOM integrated system for logistics planning. Primary control and direction is, of course, exercised by the USAECOM Command Group. Through periodic review and analysis meetings, regular consultation with staff officers, and constant interface with higher authority, the Commanding General and the Deputy Commanding Generals are well equipped to exercise the responsibilities of command by evaluating total performance and direction. It should be noted that, to balance the imperatives that are a necessary part of day-to-day operational management, and to give due weight to necessary planning, a Deputy Commanding General for Plans and Programs has

¹⁰ LRA Report CS-1295, "The Application of PERT to the USASSA Systems Management Office," Jan 1962; LRA Study 62-168, "The Extension of PERT to Multi-Project and Functional Management: PERT-C" Jan 1963; LRA Study 64-195, "Management Information System Test - PERT-C Avionics," Nov 1963.

been established as well as a Deputy Commanding General for Operations. In a more routine and formal way the Plans Office of the Comptroller/Director of Programs compares Department of Army plans and objectives against USAECOM efforts. As indicated earlier, all Department of Army projects and programs are identified with related USAECOM projects and programs so that the effort in the USAECOM will at all times be in consonance with the dynamics of Army plans and priorities. Equipment acquisition schedules, by generation of equipment and for a 20 year period, are plotted against the parent plans and programs. These are recorded by required decision points, entry into the inventory after production, and eventual disposal. The Commodity Manager explodes this acquisition schedule into a summary network plan which integrates the primary actions in all of the operating Directorates. The operating Directorates consolidate these summary equipment plans and expand them to the level of detailed planning necessary for consolidated, functional operations. It is evident from Figure 6 that coherent logistics planning can only be accomplished by the integration of all Command elements.

- Conclusion -

The preceding review of the approach to planning for balanced readiness, undertaken by the USAECOM, reveals the interdependence of logistics planning with other aspects of the total management problem: organization, identification of responsibility and authority, and management information systems. It has also attempted to show the importance of integrated planning; the establishment of a coherent overall local plan that is consistent with and responsive to the planning effort at higher levels of authority. In addition to assuring the validity of plans and operations, internal to a major organizational component of the Defense structure, the USAECOM approach provides feedback of dynamic information and meaningful supporting data which is essential to the validity of decision making at the higher levels. This review has also endeavored to give some indication of how logistics research has an important contribution to make to effective planning, materiel management, and the maintenance of combat readiness. In this regard, an essential aspect of effective logistics research is considered to be the existence of a logistics research capability at the wholesale

logistics operating levels as an autonomous unit; only by this means can a comprehensive, unbiased and vital logistics management competence be maintained and effective concepts and techniques developed, commensurate with the dynamics of military technology.

USAECOM COMMODITY MANAGER MASTER PLANS (CM₂P)

SECTION I	—	EQUIPMENT SYSTEM DESCRIPTION
SECTION II	—	WORK ASSIGNMENT SCHEDULE
SECTION III	—	WORK PLAN AND SCHEDULE
SECTION IV	—	USAECOM EQUIPMENT SYSTEM FINANCIAL PROJECTIONS
SECTION V	—	TECHNICAL PERFORMANCE NARRATIVE
SECTION VI	—	PRODUCTION SCHEDULE
SECTION VII	—	PUBLICATIONS SCHEDULE
SECTION VIII	—	TRAINING SCHEDULE
SECTION IX	—	MAINTENANCE SUPPORT PLAN

PERT-C BASED ECOM INFORMATION SYS IN SUPPORT OF COMMODITY MGMT

LIFE-CYCLE NETWORK CM2P MILESTONES

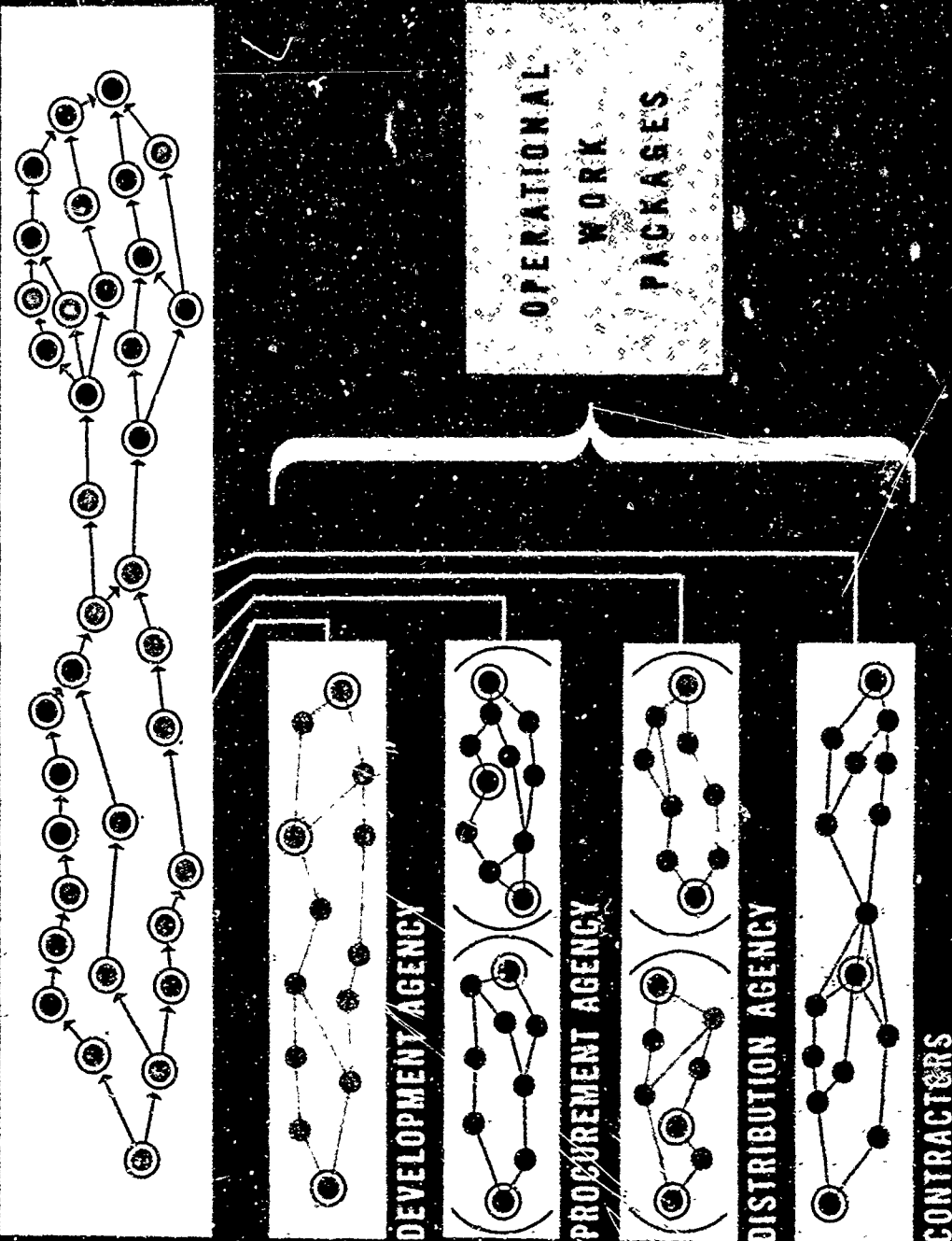


FIG 2

COHERENCE BETWEEN ECOM PROGRAMS THRU LIFE-CYCLE COMMODITY MANAGEMENT

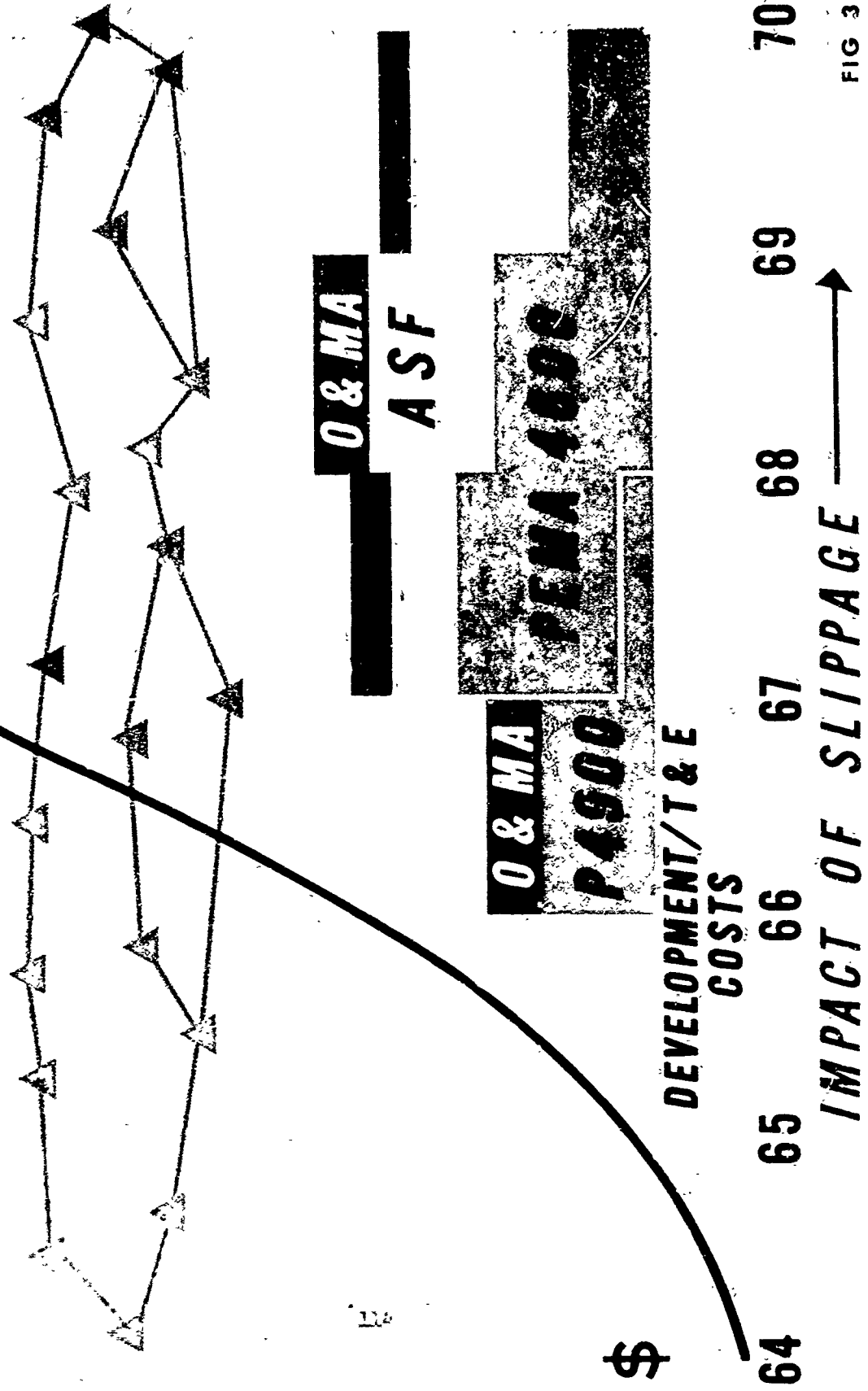


FIG 3

THE DIMENSION OF COMMODITY MATERIEL MANAGEMENT

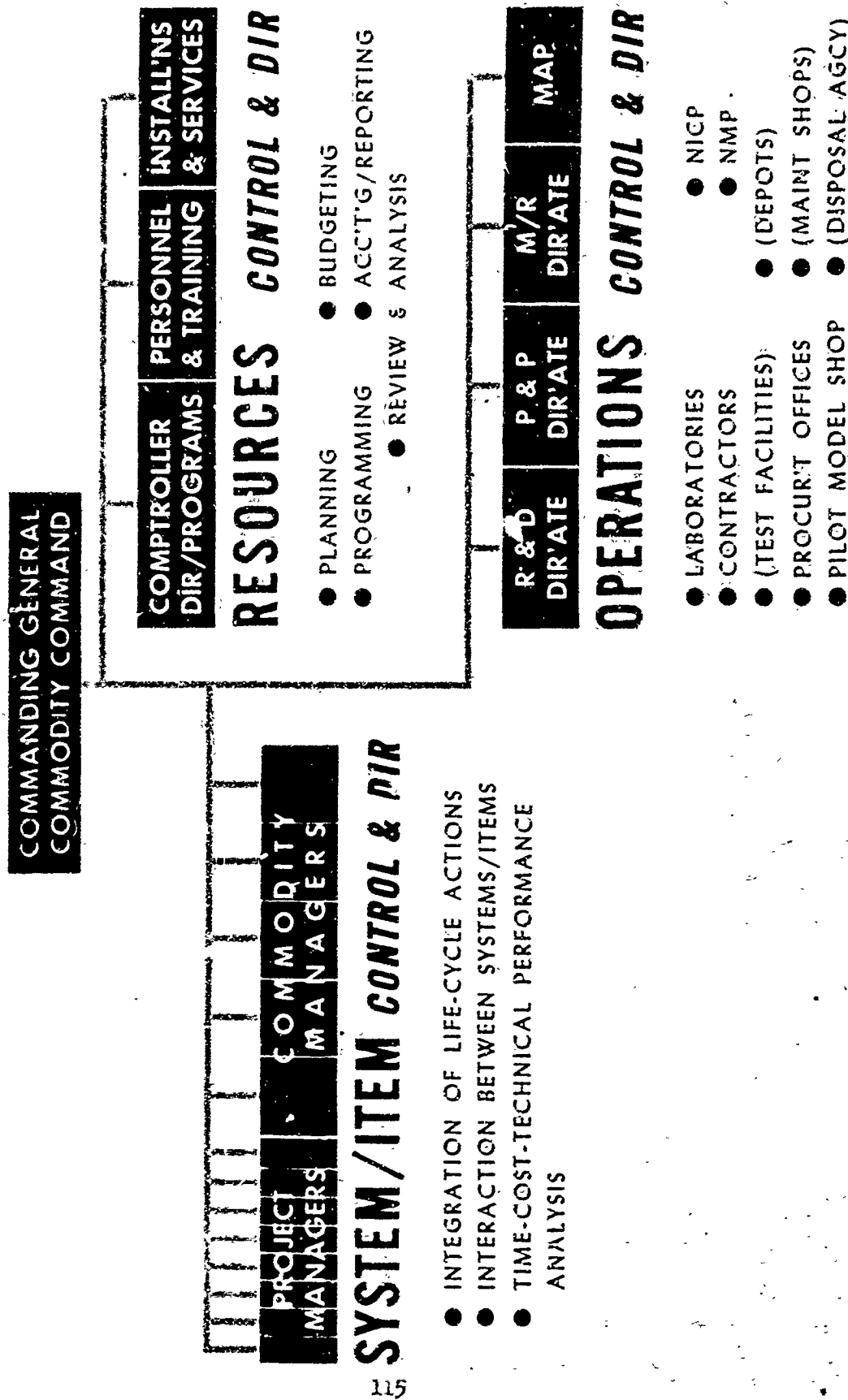


FIG 4

ELECTRONICS COMMAND

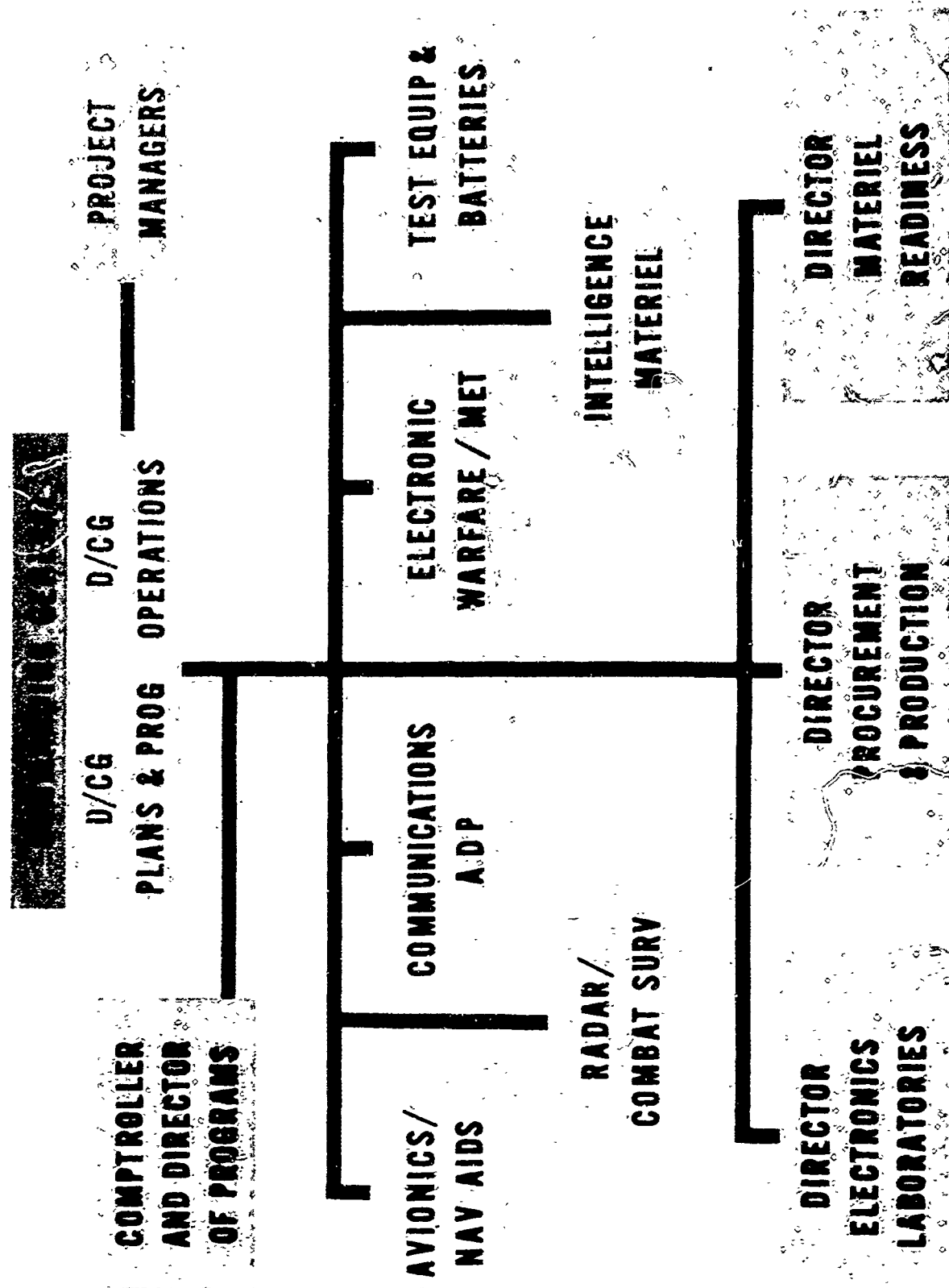


FIG 5

USAECON ADVANCE PLANNING & MGT STRUCTURE

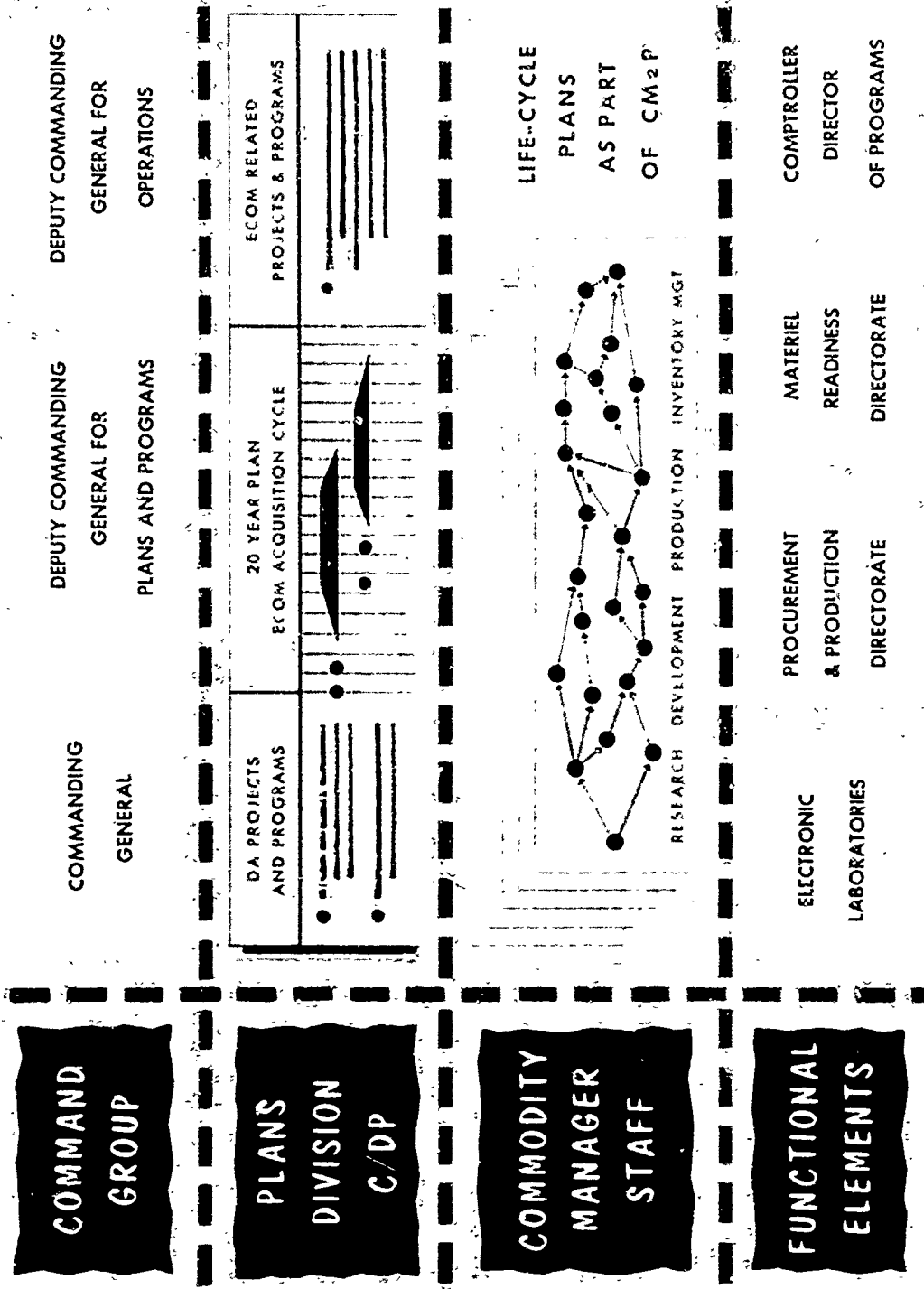


FIG 6

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ARMY SUPPORT UNIT PLANNING

by

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Prepared for the Department of Defense Logistics Research Conference

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ARMY SUPPORT UNIT PLANNING

In the chemistry of war, supplies and equipment are inert and react in the process of war only when activated by the catalyst - support units. The giant god Thor lies a mute, blind creature shivering unprotected from the elements and racked in pain, his hammer lying useless by his side, when denied the blood surging through his arteries and bearing the life-giving corpuscles of support units. The great distance traced by lines of communication, from strategic point to strategic point, over which the sandalled feet of Thor must tread, are only lines on maps of the world, Thor lacking the giant legs provided through the transport services.

These metaphors may help us to fix the importance of support units in the processes of war. In its more simple form it recognizes the functional areas in which man, the instrument of war, must be supported for successful conduct of his mission. The functional areas are not a product of modern war. They have existed since time immemorial. Man must be armed, fed, clothed, housed, transported, cared for medically, and provided the ability to observe and communicate. Man is a creature of nature and must receive certain assistance in overcoming the obstacles of environment which impede his efficiency. Otherwise, he will fail, not through lack of courage, but through his inability to cope with or establish an environment in which his courage and skill can be employed with maximum effectiveness. Establishment of such an environment is the role of the support services.

The logistic ability of a nation to wage modern war lies fundamentally in its resources of raw materials, industrial capacity, scientific knowledge, and manpower. These are only potentials. For combat, they must be

translated into fully equipped and trained forces that can be brought to bear and supported at strategic points.

Logistics is the bridge between the basic economy of a nation and the operations of the combat forces. Economic factors limit the combat forces that can be created while logistic factors limit the combat forces that can be employed.

Support units are the dynamic component of logistics. They are the means by which the bridge from the basic economy is crossed in bringing to bear effective combat forces.

A mass of supplies lying unsorted, unidentified and unavailable in the shambles of an inadequately staffed depot is useless. Supplies dumped in quagmires are a most expensive substitute for hardstands which could have been provided with the relatively few hours of construction effort made available through planning for construction support. A highly costly weapon or vehicle, out of operation by reason of lack of maintenance or spare parts, represents not the dollar cost of the item. It may well represent the failure of a combat mission with the attendant loss of the lives of men and failure of a campaign. Sick and wounded for which there is inadequate medical care not only tear at the heart strings through compassion but encumber combat operations and constitute a vital element in loss of morale, so essential to successful combat. The statement of cause of failure being, "too little and too late" through lack of careful planning for adequate transport are small compensation for those who have lost on the field of battle.

One might say we will never have enough in the form of support units. This is accepted as true. War is a "risky business" and we shall never be successful in removing risk from war. The combat forces are subjected to personal risks far beyond those faced by support units; however, an optimum balance between combat and support units must be achieved if we are to minimize the risk which the combat forces must take.

Planning for support unit forces must be willing to accept the risk of failing in certain areas if we are to maximize the combat power of the forces in contact with the enemy. Likewise, the tactician must realize that only through allocating sufficient strength to the support role can he be expected to be successful. The tactician strides with confidence and except through lessons learned on the field of battle he tends to remain oblivious of the importance of the man behind him. As cited in the histories of World War II, - "One of the most difficult problems of World War II was the provision of service units in adequate numbers.-- The statement was frequently made by commanders of task forces being readied for movement that they did not want any man without a bayonet." All too often, today's commanders charged with major campaigns were themselves rather junior officers in forward elements of combat units during their only previous engagements in combat. Support was accepted or criticized for not being there. The question was not raised in their minds regarding the source of this support. Behind them was a vast system created for the sole purpose of assuring their support. A statement credited to General George S. Patton showed senior commander's growth of awareness

of the importance of adequate support. Herein, he is reputed to have said, "Before the war I considered tactics to be 60% of success in battle and logistics 40%. After my experience in this war, I consider that logistics is possibly 60% of success and tactics 40%.

I recommend to each of you an article by Major General Crump Garvin, United States Army, Retired, published in the Military Review, April 1962, under the title of "Pitfalls in Logistic Planning".

Upon arrival in Korea, on 3 July 1950, General Garvin was instructed by General Dean to go to Pusan and set up a base to get food and ammunition to him. I shall quote excerpts from General Garvin's article.

"In our service schools it is fairly simple to work out the logistic requirements for an oversea force by using logistic manuals and reference tables.

The student planner can make his computations by pounds per man per day, measurement tons, or long tons. He may further break this tonnage down into airlift and sealift. After this chore of arithmetic is completed the student may then turn to his more pleasant role of the great tactician, moving corps, divisions, and regiments on the map to rout and defeat the enemy.

Since most Army officers have a G-3 complex, they are prone to assume that "bread, beans and bullets" will always get there somehow.--

In my opinion lack of planning had more adverse effect on logistics than it did directly on combat operations.

---- a call came to me from Tokyo asking if a type "C" logistic command would be suitable for my headquarters. Not having heard of one

Before, a short resume of the organization was given over the phone. It sounded fine to me. The next question was - how and when would it arrive? The reply was the old GI stock answer, "From personnel available to you".

In any overseas operation, if there is to be a base command port operation or logistic command, then the planners must include a suitable headquarters to supervise and oversee its operation.

Initially, the only type of motor transport at Pusan was of the combat type - mainly 2½-ton trucks. The personnel manning them were of the light truck company type. Urgent calls for these truck companies came from the forward echelons, so there was no alternative but to form indigenous truck companies. A nucleus of American officers and mechanics was needed, which we could get only by robbing existing units.

The first hospital unit to arrive for the Pusan base was a hastily gotten together group from Yokohama and Tokyo, with a rated capacity of 150 beds. It arrived about 10 July and reached its capacity of patients the first night. The next night the patient load reached 400 and the following night around 600. -- The answer to this problem was to evacuate all sick to Japan as soon as possible --. This short evacuation time resulted in a loss of badly needed manpower at a critical time. Many men had been returned to their units within a week if we had had the capability of caring for them in Korea.

The Logistic planner might conclude that since the overseas operation was to take place in a friendly country, there would surely be

sufficient common labor and skilled personnel necessary for the operation of public utilities. The railroad in Korea is a case in point. Due to the quick fall of Seoul, most of the railroad rolling stock, the terminal, and repair personnel were captured. --- this necessitated shipment of rail units from the United States. There were sufficient dock workers available in Pusan, but they were unreliable in attendance. I needed, when in full operation, about 10,000 daily; on a cold, rainy day maybe only 1,000 would show up.

Many officers lose sight of the fact that a logistic command is merely a headquarters, barely self-supporting, and can only accomplish results if support units are either assigned or attached."

This concludes those few excerpts taken from this splendid paper on some of the problems of manning an operation during its early and critical phases. These few excerpts emphasize the need for planning in great detail for the many specialists required to support a modern Army force in an overseas operation, and, some of the erroneous assumptions to which we might fall prey.

Closely allied to the problem of the determination of requirements for support units for the Department of the Army and the individual theater troop basis is the problem of provision of a complete and accurate troop list for supply purposes. Such a document is a basic requisite to adequate supply and service planning and operations. For certain purposes, such as planning for the procurement of food, most types of clothing and normal items of individual equipment, a simple projection of numbers of men and women who will be in the Army, or whom the Army

will be required to feed and clothe is sufficient. To plan for procurement of weapons, specialized clothing and equipment, construction equipment and materials, for transportation equipment and facilities of all types, and for housing and hospitalization, both in the zone of interior and overseas, it is necessary that supply echelons know the numbers of each type of unit, current and projected deployment, and general information of planned or contemplated operations. To permit the preparation of loading and shipping schedules, the ports of embarkation and the technical services must have full information as to current and projected troop bases of the theaters they support and the details of troop distribution within the theaters.

Undoubtedly, given time, the United States Army is capable of bringing into being essentially any unit required to support our combat operations. Unfortunately, in the current need for rapid response in force to cope with situations which arise throughout the globe, time is not available to mobilize, equip, train and deploy units not in being at the time of the threat. Paradoxically, the smaller the forces the greater is the need for exact balance of the support units deployed in support thereof. Given a situation in which dozens of divisions are deployed over a protracted period of time, there is opportunity to round out the balance in the force by constituting many small detachments and cellular units to fill, to minimal standards, many of the technical functions overlooked in the gross planning for the operation.

In today's Army there are some 3200 Standard Requirement Codes (SRCs). These are reflected in some 19,500 Organizations in the US Army. This organization is structured from over 1,000 Tables of Organization (TOEs).

Included in these TOEs are approximately 500 Cellular Teams designed to perform specific technical functions and so small in size that they are not susceptible to organizing into units of significantly large size as to warrant their identification as a Unit such as a Company. They perform such tasks as well drilling, firefighting, optical instrument repair, etc. Of the 1,000 plus TCEs, less than 10% compose the Combat Arms units of the Airborne, Infantry, and Armored Divisions and the Artillery units. Thus we see that the problem of combat service support unit planning is involved in planning for over 90% of the types of units and detachments required to field, support and employ the US Army in combat.

The single greatest deterrent to sound support unit planning is unwillingness to proceed with sound strategic logistic planning during periods of international calm. We have experienced six national crises since World War II. The first of these - Korea, followed by the Indo-China crisis of 1953 - then the Lebanon crisis - followed by the Berlin Build-up and the Cuban Crisis. We are now facing the Vietnam Crisis. Just as in World War II, the Department of the Army is called upon for estimates of support unit requirements and feasibility of projected military operations.

In theory, we could say that there is no real problem in times of crisis. If each element of the defense structure has carried out its missions properly we can divorce the Departmental level staff from problems of conducting the military operations. In other words, "the Commander is responsible for conduct of the military operations. He, and he alone, knows his needs and interference by those in "mahogany fox-holes" can only lead to disaster."

These concepts are quite sound but those who proclaim them fail too

often to recognize the level at which command is exercised in times of crisis. Were we concerned with a local threat, confined to a small geographic areas of the world, and one devoid of international consequences, we could rest quite comfortably under the assumption that we have a commander on the spot who can carry the military operations to successful conclusions without further consideration by planners at National or Service Departmental level.

Unfortunately, in times of crisis, each potential engagement carries international overtones, need for rapid response compresses the time available for planning, and the limitations of immediately available resources requiring that each crisis be restudied in depth and at all levels of the government in a short period of time. Our war plans are drafted on a "for instance" basis. We have over one hundred contingency plans in being. Decision regarding the combination of these plans which must be executed must await the time at which the specific threats are defined locally and internationally. At this time the plans must undergo most careful scrutiny to insure that all that is required is defined and that the resources are allocated judiciously.

In each crisis we must make hurried revisions to previous estimates and flesh out the detail provided in our generalized estimates. It is in times of crisis that the Departmental level begin to realize the enormity of the complexities and details required for effective support unit planning. Without exception, we begin to discover elements which have been overlooked or ignored in the gross aggregations employed in the planning for funding and programing in Army Force Basis planning. Once a crisis has passed the planner becomes engrossed with the pressing demands of every day activities involved in preparing and defending budgets and programs, little attention being given to developing sounder and more expeditious means for sound support troop unit planning.

One of our greatest difficulties may be in the natural tendency to structure our support units into neat vertical organizations which can be deployed and employed in essentially any area of the world, such as we do with combat units. The tactician is accustomed to thinking in terms of divisions which are readily organized into forces by assigning combat support in form of artillery, engineer, transportation, and medical units, the latter primarily for the purpose of maintaining mobility of the division medical support.

This concept fails to recognize the difference in the nature of combat power. The division is much less sensitive to many peculiarities of the economic and natural features of the environment than are support units. Decisions by the commander on the spot and during an operation can exert greater influence over tactics than over logistics, from the viewpoint of immediacy of response.

Let us look at the factors which have direct effect on support unit planning. First, in the areas of potential conflict there is a vast amount of information on the local environment (climatic, economic, geographic, and health.) These conditions change relatively slowly and type support organizations can be designed well in advance, and in detail, prior to the time at which a particular war plan must be implemented. The support structure, except for that in direct support of major combat units, must provide adequate numbers and types of technical skills for the particular geographic area and be compatible with the local environment. These factors dictate careful and detailed planning but at the same time permit this planning in advance.

Inherent in this planning is the problem of control of the support forces, structuring of the support forces to yield maximum response to the needs of the commander, and providing the flexibility of support forces required by the varied environments in which combat must be conducted.

In the past several years there have been many studies of the concepts for the modernization of our combat service support structure. These studies varied widely in basic concepts, objectives, and time frame. Generally, the studies were theoretical in nature and not readily adaptable to an orderly transition from current organization and procedures to the more advanced concepts proposed.

Analysis of the various studies and concepts advanced shows that most had certain common objectives generally:

- a. To reduce the span of control of the force commander, particularly in the area of combat service support. This in turn would enable the force commander to concentrate on his primary mission of tactical operations.
- b. To simplify the combat service support structure, provide one stop service to using units, and obtain increased responsiveness of the system to user requirements.
- c. To provide clear command lines and a higher degree of standardization in combat service support organizations and procedures for obtaining support.
- d. To provide combat service support organization capable of being easily tailored to varying force structures and environments.

In 1962, adoption of the ROAD division introduced a consolidated support command with functionalized supply and maintenance units to replace the

technical service special staff sections and branch-oriented units. Meanwhile, under DoD Project 80, the responsibility for operation of the Army wholesale logistic system within the continental United States (CONUS) was transferred from technical and administrative service chiefs to the U.S. Army Materiel Command. Thus at the end of the support system - divisions and the CONUS logistic base - new systems have been introduced. However, in the middle, technical service units have continued to provide support.

The first step in bridging the gap between functionalized service support in our present ROAD divisions and the commodity-oriented materiel management now existing in CONUS will be accomplished with the implementation of the U.S. Army Combat Developments Command study, "Combat Service to the Army (CO-STAR)", sometimes called CO-STAR II. Basically, the CO-STAR concept centralizes control of all Field Army non-divisional combat service support resources (Logistic and Administrative) under a Field Army Support Command (FASCOM). The FASCOM commander is directly responsible to the field Army commander for providing combat service support to all elements of the field Army with the exception of that provided in the division.

The organization was designed to support a three division corps, twelve division type field Army. However, the organization is flexible and can be tailored to support forces of varying composition. The combat service support is designed to improve responsiveness to requirements and provide a single source of support for user units to the maximum extent practicable. In addition, CO-STAR offers a system based, to a large extent, upon current organizations and procedures which can be adopted without serious disruption

to current field Army operations. Army-wide services for ammunition, medical transportation, civil affairs, military police, replacement and certain administrative functions are prescribed. These critical services are organized vertically under centralized control because their use is variable, dependent upon combat intensity, decision or terrain. In some cases, the services are of an intersectional nature and can be operated more efficiently under centralized control.

A major study effort of the U.S. Army Combat Developments Command, entitled "The Administrative Support, Theater Army 1965-1970 (TASTA-70)", will subsequently provide an integrated and responsive combat service support system to the entire Theater of Operations. This will complete the overall alignment of support activities which was initiated in 1962 with the ROAD division organization and Project 80.

The development and implementation of "COSTAR" and TASTA 1965-1970" will provide the means for progressive development from our current organizations to be a more responsive support structure. They will simplify control and improve responsiveness particularly for support of large scale operations in a well-developed economy. However, the tailoring of support units for relatively small, widely flung combat operations, in undeveloped countries will require exhaustive study of potential geographic areas of combat and for several different sizes of forces.

The Department of Army has employed since early 1943, an analytical, or study technique, for gaining insight into the peculiarities of specific projected military operations in various areas of the world. These are the

strategic logistic studies prepared under the direction of the DCSLOG. Department of the Army Strategic Logistic Studies provide guidance to the DA in determining requirements for combat service support units and Class IV materiel for support of projected military operation. These studies develop a plan for logistic support for a given campaign, measure the logistic costs in manpower and materiel and identify situations and problems which are likely to arise in support of campaigns. They are employed in evaluating the feasibility of logistic support plans contained in Army Component Commander plans under the Unified and Specified Commands, informing the Department of the Army regarding logistic support of military operations which may be projected for establishing Army guidance or response to the Joint Chiefs of Staff or DOD. They are not in themselves the basis for entering materiel requirements into the Army Materiel Plan but serve as source documents for review and approval of Operational Projects, the current basis for reflecting requirements for Class IV items of materiel in the Army Materiel Plan. These studies provide for continuation of the logistic planning done by the Operations Plans Division, Army Service Forces, during World War II and provide the insight essential to planning support units for projected military operations in specific areas of the world.

In addition to the strategic logistic studies, currently being performed to a large extent by means of computer-assisted simulation techniques, the Department of the Army employs a system of "Functional Components", a modification of the Navy system. At present the Army employs only the Functional Components for engineer tasks, and these components do not contain

within themselves statements of support units required to provide the facilities and operate the facilities. The "Engineer Functional Components System" was initiated by the Chief of Engineers in response to Logistics Plans Group Memorandum 456, which recommended that the Services adopt parallel methods for estimating broad military requirements such as the support of military operations. This system is a valuable aid to overseas commanders in their preparation of support unit requirements in that it provides the labor estimates required for determining the construction troops required. Likewise, it is a valuable tool for use by the Department of the Army Staff in preparing logistic feasibility tests of Army Component Commander's plans and the logistics studies conducted by DCSLOG. Additionally, they provide ready means for programming the staff tables to computers as assistance in conducting war games and simulations. The "Engineer Functional Components System", although a valuable tool for estimating construction requirements, is deficient in that it deals only with engineer functions and does not include the broader treatment of technical support missions.

Another device used by the Department of the Army is planning support units are the "Force Planning Guides". These have been developed for a General War condition in a highly developed country and for a Limited War or Contingency situation, employing an Army Corps Force in an undeveloped area of the world. Although these Force Planning Guides are useful in structuring the support forces in their grosser proportions, for use in budgeting and programming, they do not provide the depth of insight required for planning in depth the support units requirements for specific military operations.

Building on the tools discussed above (COSTAR, TASTA, the Strategic Logistic Studies, and the Engineer Functional Components System) the Army has the means for developing sound requirements for the many technical specialities required of support units in the various geographic areas of the world, and for varied sizes of forces.

Much remains to be done in providing sound and expeditious procedures for support unit planning. Expansion of the Functional Components System and improved techniques for computer-assisted simulations and war games offer real possibilities toward progress in this area. This is the direction in which I consider our operations research effort can be most effectively employed to bring the Army the required capability in support unit planning.

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